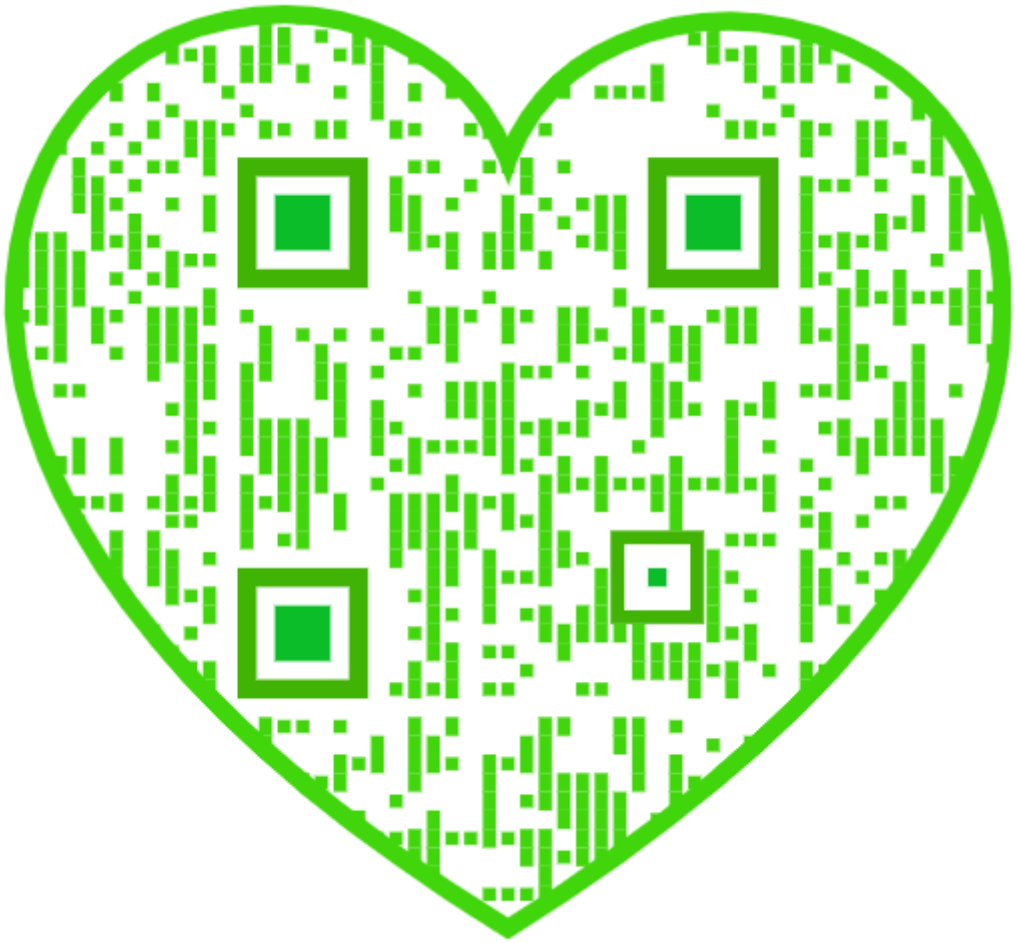

Hinds, Hayden & Eldredge Textbooks by Grades

ARITHMETIC BY GRADES

BOOK THREE

BY

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PREFACE

THIS book, the closing volume in a new series of practical arithmetics, and covering the ordinary course for the seventh and eighth school years, is designed to instruct, interest, and encourage pupils in the varied applications to practical work of the mathematical knowledge and skill they have acquired in the practice of the preceding years. Two elements in the arithmetic work of the final two years of the course are essential: the problems introduced and the situations employed must be real to the pupil and well within his comprehension, and the reasons why the solution of these or identical problems is necessary in life must be understood clearly. The last requirement is vital in the work of these years in interest, bank discount, taxes, insurance, measurement, and all the other wide applications in the world of commerce, industry, and civic affairs. In other words, in order intelligently to apply his skill in the fundamental operations to the problems of everyday life, and to determine the steps to be employed in their solution, the pupil must first, by reading and discussion, understand and appreciate his relation to those social institutions and commercial and industrial practices with which business processes are associated.

The books of this series are definitely topical in arrangement within each half year. This arrangement permits the pupil to dwell upon one topic long enough to insure mastery, permits of ready use of the book for reference, and allows an opportunity for ample review work. It is hoped that the method, and particularly the manner, of presentation will not only guide but also interest the majority of the pupils in the selections because of the applicability of their arithmetical content to the everyday affairs of every one's life.

The authors have never lost sight of the fact that a thorough and persistent drilling in the fundamental operations is vital in arithmetic work to the very close of the course: short methods of solution, oral and written reviews, rapid calculations, and drill in the fundamentals have been introduced. So abundant is the drill provided, whether general drill practice or topical exercises, that the pupils ought to become actually facile in that accuracy and speed in figuring which stand one in such good stead in the days' routine.

The authors have attempted to embody in this series the results growing out of the experience and criticism of the most successful teachers of the past few years, and to follow the spirit of the courses of study of the most progressive cities and states, especially in the matter of the elimination of obsolete methods and topics and the exclusion of impractical problems and unbusinesslike situations. They have tried to reduce the explanations of formal processes to the most economical and complete forms for use in the study of new lessons. In the wording of problems, in the use of abbreviations, and in the avoidance of any routine order of presentation or questioning, they have tried constantly to throw the pupil upon his own resources.

It is of vital importance that pupils be taught as early as possible the intelligent use of a textbook, for the book is to become the chief source of knowledge when school days are over. An effective text should be planned so as not merely to supply series of exercises or problems, but also to enable a teacher to instruct pupils in the art of acquiring knowledge from the book, and in this way to foster mental independence, develop self-reliance, and promote self-instruction.

The authors in this closing volume gratefully acknowledge their indebtedness to those friends, both principals and teachers, who have aided freely in the preparation of this series by their advice and suggestions. The publishers also venture to join the authors in these acknowledgments.

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CONTENTS

SEVENTH YEAR BOOK

FIRST HALF: GRADE 7 A

	PAGE
I. Review of Fundamental Operations	1
II. Percentage	13
III. How Money Earns Money: Interest	46
IV. Saving and Investing Money	57
V. Measurement	70
VI. Business Forms and Practice	81
VII. Simple Equations: Optional Work	93

SECOND HALF: GRADE 7 B

I. Drill in Fundamental Operations	105
II. Applications of Percentage	113
III. Borrowing and Lending Money	136
IV. Borrowing and Lending Money: Bank Discount	147
V Measurement	159
VI. Business Forms and Practice	176
VII. Simple Equations: Optional Work	186
Tables for Reference	193
Index	200

ARITHMETIC BY GRADES

SEVENTH YEAR BOOK

FIRST HALF: GRADE 7A

I. REVIEW OF FUNDAMENTAL OPERATIONS

The New Work of the Seventh Year. You are entering upon the seventh year of arithmetic work and should by this time understand thoroughly the four operations of addition, subtraction, multiplication, and division—not only of whole numbers, but of common fractions. Now, it becomes your task to make yourself more familiar with some of the varied applications that are made of arithmetic in the business world of to-day. You have studied some of these in commission, discount, interest, bills, and checks; you will study now the further uses of arithmetic in the world around you.

The Constant Need of Accuracy. It is very important for you to remember that you are not through with the daily drill in arithmetic. Boys and girls, fresh from school, beginning work in stores, shops, and offices, are not asked by business men to work out difficult problems or to compute with large numbers or fractions. The constant demand

of business men is that these boys and girls be able to copy numbers correctly, to write them from dictation, to add, subtract, multiply, and divide whole numbers accurately; that they be able to multiply and divide numbers quickly by moving the decimal point; that they be able to use all the short methods of computing with numbers; that they be careful to check every addition and subtraction on a sales slip, a bill, a balance sheet, or a stock card.

Three Cautions for the Pupil. The correct answer always is worth more than the rapid answer. While the business man prefers that his employee be quick at numbers, he insists that he be accurate. In the business world the only passing mark in arithmetic is 100%. Therefore, remember always, in all grades:

(*a*) Write all figures neatly and clearly, the horizontal lines level and the columns straight.

(*b*) Perform all operations by the shortest method you know.

(*c*) *Check every answer* before you lay down your pencil.

ORAL DRILL

State totals quickly:

1.	8	7	6	5	4	3	2	9	7
	4	5	3	5	8	5	2	3	5
	5	2	3	7	8	5	2	2	4
	3	4	4	2	3	6	7	2	2
2.	12	18	27	34	43	31	47	52	61
	2	3	8	4	8	9	3	8	4
	5	7	5	7	7	4	5	2	6
	4	2	9	5	3	5	6	5	2

ORAL EXERCISE

Add the following:

Method:	326+49:	326+40=366 366+ 9=375

1. 246+54	743+57	116+79	245+58
2. 525+28	347+36	213+24	143+92
3. 118+68	105+52	514+67	414+47
4. 137+29	339+69	436+81	616+35

Subtract:

Method:	721−56:	721−50=671 671− 6=665

5. 436−27	981−48	672−88	136−75
6. 713−36	103−39	235−53	502−29
7. 596−48	725−34	611−42	437−51
8. 413−49	918−35	224−63	859−72

Notation and Numeration. The symbols, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, used in writing numbers, are **Arabic** numerals.

In the number 946, what does 6 represent? What does 4 represent? What does 9 represent?

The orders of numbers, reading from right to left, are: units, tens, hundreds, thousands, ten thousands, etc.

Read:

1. 846,705	5,284,700	17,341,122
2. 904,362	7,860,001	32,999,621

The figures of a number are set off by commas, beginning at the right, into groups of three. The last group, that at the left, will consist of one, two, or three figures. These groups are called **periods.**

The first six periods, reading from right to left, are: units, thousands, millions, billions, trillions, and quadrillions.

Roman Numerals. What is the difference between Arabic and Roman numerals?

1. Read:

I	II	III	IV	V	VI	VII	VIII	IX
X	XI	XIV	XV	XVI	XVII	XIX	XX	XXX

L = 50 C = 100 D = 500 M = 1000

2. Read:

XXX	XVII	LXI	CL	CLXII
CIX	MD	CD	XIX	MDCXLIX

Add the values of the letters when a letter is followed by one or more letters of the same or less value.

CCC = 300 XIII = 13

Subtract the values of the letters when a letter is followed by one of greater value.

IX = 9 CD = 400

A horizontal bar over a letter increases its value 1000 *times.*

$\overline{C} = 100{,}000$ $\overline{D} = 500{,}000$

1918 = 1000 (M), +900 (CM), +18 (XVIII), or MCMXVIII

3. Read:

XL	LXVI	MCXIV	CLX	CCXIX
MCCX	MCLI	$\overline{X}$LIV	MCDXI	LXVII

4. Write in Roman numerals:

49	224	1492	1776	1861
1877	1914	1925	1620	1781

Making Change. A girl buys meat for 42¢ and gives the cashier a two-dollar bill. How much change should she receive?

The cashier will look at the sales slip and say, "42 cents." He will then count out 3 cents, a nickel, 2 quarters, and a dollar bill, saying, "45, 50, 75, $1, $2."

ORAL EXERCISE

What change should be given for the amounts at the left if the following purchases are made?

1.	$1.00	$ .69	$ .87	$ .29	$ .36	$ .16	$ .13	$ .18
2.	1.00	.56	.71	.49	.52	.83	.21	.47
3.	2.00	.84	1.39	1.54	1.11	.72	1.88	1.45
4.	2.00	1.31	1.67	.24	1.48	1.66	1.52	.39
5.	5.00	2.45	1.29	2.40	3.37	4.44	1.60	2.84
6.	5.00	1.18	2.69	3.43	1.64	4.55	2.93	1.34
7.	10.00	3.72	7.72	6.64	9.11	4.98	3.38	8.85
8.	10.00	5.16	6.24	7.13	3.12	1.76	1.82	4.17

WRITTEN EXERCISE

Add rapidly. Check by adding in the opposite direction. Keep a record of your time in each drill.

1.	2.	3.	4.	5.
482	9083	5467	$71.23	$149.80
975	3645	2245	46.54	920.80
400	5469	3657	65.13	675.20
721	7308	5496	93.22	920.30
932	2256	1989	14.86	366.30
374	9007	2406	54.07	725.90
507	5423	5007	97.03	627.20
142	7586	3439	32.25	798.40
630	2937	6113	42.16	346.30
904	6934	5675	43.97	935.60

6.	7.	8.	9.	10.
725	4385	8219	$82.64	$100.80
200	9516	9103	59.37	522.50
743	8567	5463	82.47	384.75
540	9289	5895	39.93	926.03
720	1352	7562	22.36	127.90
905	1968	7978	19.33	874.23
781	2255	9861	75.75	978.99
666	1870	2093	83.10	324.58
129	2783	9760	13.88	752.77
532	6534	2709	45.45	910.43

11.	12.	13.	14.
$250.08	59,004	72,891	$98.484
374.13	7,347	36,403	5.263
546.03	19,208	41,004	12.475
712.14	58,507	37,712	82.496
380.56	13,046	54,119	7.487
490.49	54,643	54,104	3.639
538.37	47,876	31,942	43.565
701.49	32,854	17,419	82.258
451.94	82,526	81,423	94.732
364.54	11,556	82,896	52.565

Subtract, check, and record your time in each drill:

15.	16.	17.	18.
54,326	36,401	82,211	914,152
28,978	19,846	78,436	199,978

19.	20.	21.
$3800.30	327,018	$5650.29
2846.45	127,489	4886.39

22.	23.	24.	25.
324,017	20,000	540,079	963,842
298,159	12,839	425,989	495,987

26.	27.	28.
552,111	233,008	392,102
496,589	198,457	206,668

ORAL EXERCISE

1.	54×5	72×9	16×9	75×8	16×5
2.	63×4	28×5	49×6	23×5	47×9
3.	72×7	15×8	27×7	84×4	69×6
4.	81×9	83×4	54×8	36×3	72×4
5.	94×8	36×7	63×5	93×7	18×7
6.	28×4	47×3	38×3	27×2	36×5

WRITTEN EXERCISE

Multiply, using short methods:

1.	28×250	516×250	$534\times66\frac{2}{3}$	438×25
2.	$88\times12\frac{1}{2}$	$843\times16\frac{2}{3}$	812×125	926×50
3.	22×125	428×500	$426\times33\frac{1}{3}$	944×50
4.	86×250	824×125	743×500	482×25
5.	$72\times33\frac{1}{3}$	$483\times14\frac{2}{7}$	324×250	300×75

ORAL EXERCISE

Tell the answers quickly:

1.	48 lb. @ \$.25	24 lb. @ \$.75	45 lb. @ \$.$66\frac{2}{3}$
2.	32 lb. @ .25	54 lb. @ .50	48 lb. @ .$83\frac{1}{3}$
3.	56 yd. @ .$12\frac{1}{2}$	32 yd. @ .$37\frac{1}{2}$	40 yd. @ .$62\frac{1}{2}$
4.	48 yd. @ .$37\frac{1}{2}$	64 yd. @ .$12\frac{1}{2}$	24 yd. @ .$87\frac{1}{2}$
5.	66 lb. @ .$12\frac{1}{2}$	66 lb. @ .50	72 lb. @ .$16\frac{2}{3}$
6.	60 lb. @ .$66\frac{2}{3}$	60 lb. @ .75	120 lb. @ .$16\frac{2}{3}$
7.	96 yd. @ .$12\frac{1}{2}$	132 yd. @ .$16\frac{2}{3}$	88 yd. @ .$37\frac{1}{2}$
8.	120 yd. @ .$62\frac{1}{2}$	160 yd. @ .75	240 yd. @ .$87\frac{1}{2}$

WRITTEN EXERCISE

Divide:

1.	$14{,}892\div204$	4. $77{,}112\div408$	7. $477{,}442\div509$
2.	$65{,}664\div144$	5. $328{,}320\div912$	8. $246{,}447\div591$
3.	$245{,}548\div628$	6. $396{,}372\div804$	9. $472{,}131\div753$

WRITTEN PROBLEMS

Populations:

Alabama	2,138,093	Maine	742,371
Connecticut	1,114,756	Massachusetts	3,366,416
Delaware	202,322	New Jersey	2,537,167
Georgia	2,609,121	New York	9,113,279
Illinois	5,638,591	Pennsylvania	7,665,111

1. Find the total population of these ten states.

2. How many more people live in Pennsylvania than in Georgia, Maine, and New Jersey together?

3. Tell the difference in population between New York and Connecticut; between Georgia and Delaware.

4. By how much does the population of Massachusetts exceed that of Alabama and Delaware combined?

5. How much greater is the population of New York than that of Massachusetts, New Jersey, and Connecticut together?

6. How much greater is the population of Alabama than that of Delaware? Of Pennsylvania than that of Maine? Of New York than that of Massachusetts?

7. Find the total population of the five most populous of these states. By how much does this total exceed that of the other five?

ORAL EXERCISE

Reduce to lowest terms:

1. $\frac{48}{88}$ $\frac{63}{81}$ $\frac{15}{95}$ $\frac{50}{85}$ $\frac{15}{55}$ $\frac{45}{100}$ $\frac{75}{135}$ $\frac{35}{150}$

2. $\frac{33}{77}$ $\frac{35}{60}$ $\frac{54}{81}$ $\frac{27}{45}$ $\frac{45}{85}$ $\frac{50}{200}$ $\frac{24}{140}$ $\frac{100}{420}$

Add or subtract as indicated:

3. $1\frac{3}{4}+\frac{3}{4}$ $4\frac{7}{8}+\frac{3}{8}$ $3\frac{1}{6}+\frac{3}{4}$ $3\frac{1}{4}+\frac{2}{3}$

4. $2\frac{1}{2}-\frac{3}{8}$ $4\frac{1}{6}-\frac{5}{6}$ $2\frac{7}{8}-\frac{1}{4}$ $4\frac{3}{4}-\frac{1}{2}$

Multiply or divide as indicated:

5.	$3 \times \frac{3}{7}$	$\frac{6}{7} \times \frac{3}{4}$	$3 \times 2\frac{2}{3}$	$5 \times \frac{3}{11}$
6.	$\frac{9}{4} \div 3$	$\frac{5}{8} \div \frac{1}{5}$	$\frac{4}{17} \div 8$	$\frac{3}{16} \div \frac{1}{8}$
7.	$\frac{11}{33} \div \frac{2}{3}$	$\frac{5}{12} \times \frac{6}{7}$	$\frac{3}{8} \div \frac{3}{4}$	$11 \times \frac{5}{12}$

Find these fractional parts:

8.	$\frac{1}{4}$ of 48	$\frac{6}{7}$ of 63	$\frac{4}{5}$ of 24	$\frac{3}{10}$ of 100
9.	$\frac{3}{5}$ of 75	$\frac{2}{5}$ of 60	$\frac{2}{7}$ of 35	$\frac{4}{15}$ of 60
10.	$\frac{2}{3}$ of 30	$\frac{5}{9}$ of 81	$\frac{3}{8}$ of 56	$\frac{7}{12}$ of 48
11.	$\frac{2}{5}$ of 55	$\frac{2}{3}$ of 45	$\frac{7}{8}$ of 48	$\frac{3}{11}$ of 77

Tell what part the first number is of the second:

12.	2 : 24	5 : 75	6 : 48	28 : 56	10 : 60
13.	5 : 35	4 : 48	3 : 51	25 : 55	20 : 65
14.	3 : 66	7 : 49	4 : 72	22 : 88	14 : 70
15.	4 : 66	9 : 45	7 : 84	32 : 96	16 : 42

Find the number of which:

16.	23 is $\frac{1}{3}$	48 is $\frac{4}{5}$	15 is $\frac{3}{4}$	32 is $\frac{4}{5}$
17.	52 is $\frac{2}{3}$	18 is $\frac{1}{8}$	30 is $\frac{6}{7}$	24 is $\frac{2}{3}$
18.	18 is $\frac{3}{4}$	72 is $\frac{8}{9}$	9 is $\frac{1}{11}$	42 is $\frac{1}{4}$
19.	36 is $\frac{3}{5}$	24 is $\frac{12}{13}$	45 is $\frac{3}{10}$	25 is $\frac{5}{6}$

WRITTEN EXERCISE

Find results:

1.	$23\frac{4}{5} + 17\frac{2}{15} + 4\frac{1}{10} + 7\frac{3}{5}$		$6\frac{3}{8} + 8\frac{1}{2} + 4\frac{7}{12} + 3\frac{5}{6}$
2.	$3\frac{9}{10} + 1\frac{11}{12} + 2\frac{4}{15} + 5\frac{3}{5}$		$5\frac{4}{5} + 9\frac{3}{8} + 8\frac{5}{12} + 6\frac{1}{2}$
3.	$137\frac{1}{4} - 73\frac{4}{5}$	$86\frac{4}{15} - 17\frac{1}{2}$	$37\frac{2}{7} - 9\frac{7}{10}$
4.	$(8\frac{2}{3} - 1\frac{3}{4}) + (16\frac{5}{6} - 7\frac{1}{3})$		$(18\frac{2}{3} + 6\frac{1}{2}) - (4\frac{1}{2} + 4\frac{7}{8})$

Multiply:

5.	$2\frac{1}{2} \times \frac{7}{8}$	$8\frac{3}{4} \times \frac{4}{5} \times \frac{5}{12}$	$2\frac{1}{2} \times \frac{4}{9} \times \frac{7}{8} \times 24$
6.	$8\frac{4}{7} \times 44$	$3\frac{1}{16} \times 28 \times 34$	$\frac{3}{4} \times 1\frac{1}{12} \times 3\frac{1}{3} \times 42$
7.	$5\frac{3}{8} \times \frac{1}{4}$	$\frac{4}{5} \times 2\frac{5}{8} \times 8\frac{7}{8}$	$\frac{8}{9} \times \frac{3}{5} \times 45 \times \frac{10}{25}$

Divide:

8. $27\frac{2}{5} \div 8\frac{2}{3}$ $45 \div 1\frac{2}{3}$ $72 \div \frac{12}{17}$ $8\frac{2}{3} \div \frac{4}{15}$
9. $8\frac{3}{4} \div 1\frac{7}{8}$ $90 \div 2\frac{3}{4}$ $60\frac{1}{4} \div \frac{3}{4}$ $9\frac{1}{2} \div 2\frac{3}{8}$
10. $20\frac{5}{6} \div 5\frac{2}{9}$ $84 \div \frac{6}{11}$ $64 \div \frac{5}{8}$ $4\frac{5}{6} \div 3\frac{1}{2}$

Reduce to decimals:

11. $\frac{1}{40}$ $\frac{3}{16}$ $\frac{7}{50}$ $\frac{5}{16}$ $\frac{9}{16}$ $\frac{3}{20}$ $\frac{4}{25}$ $\frac{9}{20}$
12. $\frac{7}{16}$ $\frac{3}{25}$ $\frac{3}{40}$ $\frac{7}{25}$ $\frac{19}{20}$ $\frac{91}{25}$ $\frac{11}{40}$ $\frac{9}{25}$

Change to common fractions:

13. .56 .65 .18 .32 .625 .125 .0675
14. .88 .22 .24 .35 .875 .075 .1875

Add and check each total:

15. 6.208 / 47.1 / 96.842 / 14.055 / 3.64 / 22.87
16. 5.4232 / 6.1 / 75.084 / 3.434 / 27.008 / 9.98
17. 9.8463 / 55.41 / 6.0004 / 76.245 / 7.4071 / 2.345
18. 25.251 / 6.543 / 78.841 / 5.009 / 22.713 / 8.041

Subtract and check:

19. 8.0042 − 6.6854
20. 4.8254 − 1.27
21. 8000. − 725.0625
22. 42.012 − 4.873
23. 2.428 − 2.1986
24. .805 − .6661
25. 7. − .1254
26. 500.000 − 125.375

Multiply and check:

27. $82.45 \times .009$
28. $1.37 \times .4605$
29. 23.041×2.5
30. 37.17×48
31. $.0402 \times 26$
32. 8.045×18
33. 82.04×3.71
34. $9.601 \times .123$
35. 2.75×1.843

Divide and check:

36. $393.46 \div 103$
37. $17.787 \div 121$
38. $835.07 \div 113$
39. $19.740 \div .188$
40. $44.472 \div 1.02$
41. $879.79 \div .907$
42. $1402. \div 1.57$
43. $.1468 \div 1088$
44. $19.781 \div 131$

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	120 ft. @ $.25	48÷2	½% of 400	112+88	6)96
2.	150 ft. @ .20	84÷6	⅓% of 600	417+37	13)65
3.	180 ft. @ .50	68÷4	¼% of 800	213+46	3)39
4.	160 ft. @ .50	110÷5	⅕% of 1000	346+91	27)54
5.	200 ft. @ .75	159÷3	⅛% of 1600	238+43	12)96

	What per cent of:		*State results:*		
6.	60 is 15?	¾ is ¼?	9×?=63	$1.25−$.48	26×2
7.	72 is 12?	⅗ is ⅖?	76÷?=38	1.49− .69	37×2
8.	81 is 9?	⅜ is ⅔?	5×?=225	2.38− .57	23×6
9.	40 is 8?	¼ is ½?	56÷?=4	2.51− .63	22×7
10.	35 is 5?	¾ is ½?	7×?=161	3.69− .75	24×5

	Change to common fractions:				*Solve:*	
11.	.6	.125	6¼%	10%	36÷10	⅜×210
12.	.8	.25	7%	15%	3.6÷10	¾×600
13.	.5	.375	4%	65%	.36÷100	$\frac{3}{11}$×880
14.	.12	.625	20%	45%	58÷10	⅝×320
15.	.24	.75	2½%	35%	5.8÷10	⅔×480
16.	.18	.875	60%	95%	5.8÷100	⅝×720

	Find values:				
17.	12½% of $480	⅝×⅔	8⅓% of 48	4.1×3	½÷⅜
18.	14⅔% of 210	⅜×⅝	30% of 60	5.2×4	⅔÷$\frac{5}{12}$
19.	37½% of 640	⅝×¾	33⅓% of 54	7.2×5	⅚÷¾
20.	66⅔% of 390	⅔×⅜	62½% of 64	3.0×.6	⅝÷⅝
21.	83⅓% of 360	$\frac{7}{12}$×⅚	2% of 800	4.8×.25	¾÷$\frac{8}{11}$

22.	$2.64−$.75	4.5×10	325+85	.48÷.6	120+54
23.	3.14− .48	.45×100	605+95	4.8÷.3	310+86
24.	1.98− .39	8.1×30	415+75	.24÷.8	260+97
25.	3.39− .56	.81×1000	545+65	2.4÷1.2	480+38
26.	2.25− .69	.26×50	815+95	4.8÷.16	340+52

GENERAL WRITTEN PROBLEMS

1. A dealer bought 4800 lb. of rice at $4\frac{3}{8}¢$ a pound and sold it at $7\frac{1}{4}¢$ a pound. What was his profit?

2. What will it cost to build a cement road $5\frac{1}{2}$ ft. wide and 78 ft. long, at \$1.35 a sq. yd.?

3. The full railway fare between Syracuse and Albany is \$2.96. What will be the cost of tickets for a family consisting of father, mother, and three children, if each child travels on a half-fare ticket?

4. How much will it cost to excavate a cellar 42 ft. long, 26 ft. wide, and $7\frac{1}{2}$ ft. deep, at $55¢$ a cu. yd.?

5. One side of a square field is 40 rods long. How many acres are there in this field?

6. A grocer bought maple syrup at $90¢$ a gallon and sold it in quart bottles at $45¢$ a qt. If the bottles cost $5¢$ each, what will be the profit on 300 gal.?

7. The frame of a hat cost 75 cents. It was covered with $1\frac{1}{2}$ yd. of velvet at \$1.50 a yd.; the trimmings cost \$4.50. If the making cost \$1.50, what was the total cost of the hat?

8. If a boy buys peaches at the rate of 5 for 2 cents, and sells them at the rate of 4 for 3 cents, how many must he buy and sell to make a profit of \$4.20?

9. In a relay race, the first girl's time was $11\frac{3}{5}$ seconds, the second girl's time was $10\frac{2}{3}$ sec., the third girl's was $12\frac{1}{2}$ sec., and the fourth girl's $9\frac{7}{8}$ sec. How long did it take to complete the race?

10. A stationer bought pencils for \$3.60 per gross; he sold them for 4 cents apiece. Did he gain or lose? What per cent?

11. If the remainder be 17, the quotient 610, and the dividend 45,767, what is the divisor?

II. PERCENTAGE

Terms in Percentage. A clerk spends for rent 22% of his income of $2400.

You have learned that percentage is a method of reckoning by the hundredths. Therefore, this clerk spends for rent 22 cents out of every 100 cents that he earns.

$2400 is called the **base.** It is the amount upon which the percentage is figured.

22%, the number of the hundredths considered, is called the **rate** or the **rate per cent.** When you multiply the base by the rate, you obtain the **percentage.**

How do you find the rate when you know the base and the percentage?

ORAL EXERCISE

1. Explain what is meant by saying that, at a sale, bedroom furniture is reduced $33\frac{1}{3}\%$.

2. The price of oil has risen 8%. Express this in terms of hundredths instead of percentage. In terms of dollars and cents.

3. 50 girls were registered in a class. 10% of them were absent. Say it in terms other than of percentage.

4. An agent bought a farm very cheaply and sold it at a profit of 100%. Say it in terms of dollars.

5. A clerk's salary was $1200 a year. If it is raised 50%, how much does he receive now?

Changing Common Fractions to Per Cents.

$$\frac{5}{7}=\frac{71\frac{3}{7}}{100}=71\tfrac{3}{7}\% \qquad \frac{4}{15}=\frac{26\frac{2}{3}}{100}=26\tfrac{2}{3}\%$$

Express the following as per cents:

1. $\frac{1}{8}$	6. $\frac{7}{8}$	11. $\frac{1}{12}$	16. $\frac{3}{5}$	21. $\frac{18}{25}$
2. $\frac{5}{4}$	7. $\frac{5}{12}$	12. $\frac{6}{35}$	17. $\frac{8}{9}$	22. $\frac{3}{24}$
3. $\frac{5}{6}$	8. $\frac{1}{16}$	13. $\frac{2}{15}$	18. $\frac{9}{210}$	23. $\frac{11}{12}$
4. $\frac{3}{7}$	9. $\frac{10}{10}$	14. $\frac{4}{3}$	19. $\frac{5}{8}$	24. $\frac{1}{32}$
5. $\frac{3}{5}$	10. $\frac{7}{12}$	15. $\frac{3}{20}$	20. $\frac{9}{9}$	25. $\frac{1}{44}$

Changing Decimals to Per Cents.

$.16 = 16\%$ $.0075 = .00\frac{3}{4}$ or $\frac{3}{4}\%$

$.02\frac{1}{2} = \frac{1}{22}\%$ $2.6\frac{1}{2} = 2.65$ or 265%

To change a decimal to a per cent, move the decimal point two places to the right and add the per cent sign.

ORAL EXERCISE

Express the following as per cents:

1. .25	7. .125	13. 1.525	19. 9.875
2. .75	8. 3.25	14. .0475	20. .0085
3. .59	9. $.07\frac{1}{2}$	15. .0875	21. 5.347
4. .67	10. .035	16. .0015	22. 9.375
5. .11	11. 7.5	17. .0325	23. .6255
6. .82	12. .006	18. 7.254	24. 1.625

Changing Per Cents to Decimals.

$43\% = .43$ $7\frac{1}{2}\% = .075$ $416\% = 4.16$ $2.2\% = .022$

To change a per cent to a decimal, move the decimal point two places to the left, and omit the per cent sign.

WRITTEN EXERCISE

Write as decimals, integers, or mixed decimals:

1. 21%	5. $8\frac{1}{3}\%$	9. $\frac{1}{2}\%$	13. 7%	17. 700%
2. 102%	6. 225%	10. $\frac{4}{5}\%$	14. 2%	18. 488%
3. $12\frac{1}{2}\%$	7. $6\frac{1}{4}\%$	11. $\frac{3}{4}\%$	15. 4%	19. 512%
4. 63%	8. $35\frac{1}{2}\%$	12. $\frac{1}{8}\%$	16. 11%	20. 225%

Table of Per Cent Equivalents:

$\frac{1}{2}=50\%$	$\frac{3}{5}=60\%$	$\frac{5}{8}=62\frac{1}{2}\%$	$1=100\%$
$\frac{1}{4}=25\%$	$\frac{4}{5}=80\%$	$\frac{7}{8}=87\frac{1}{2}\%$	$\frac{1}{11}=9\frac{1}{11}\%$
$\frac{3}{4}=75\%$	$\frac{1}{6}=16\frac{2}{3}\%$	$\frac{1}{9}=11\frac{1}{9}\%$	$\frac{1}{12}=8\frac{1}{3}\%$
$\frac{1}{3}=33\frac{1}{3}\%$	$\frac{5}{6}=83\frac{1}{3}\%$	$\frac{1}{10}=10\%$	$\frac{1}{16}=6\frac{1}{4}\%$
$\frac{2}{3}=66\frac{2}{3}\%$	$\frac{1}{7}=14\frac{2}{7}\%$	$\frac{3}{10}=30\%$	$\frac{1}{20}=5\%$
$\frac{1}{5}=20\%$	$\frac{1}{8}=12\frac{1}{2}\%$	$\frac{7}{10}=70\%$	$\frac{1}{25}=4\%$
$\frac{2}{5}=40\%$	$\frac{3}{8}=37\frac{1}{2}\%$	$\frac{9}{10}=90\%$	$\frac{1}{50}=2\%$

To Find Percentages. State results orally:

1. 25% of \$240
2. $14\frac{2}{7}\%$ of \$490
3. 75% of \$2400
4. 50% of \$840
5. 20% of \$450
6. 30% of \$2700
7. $12\frac{1}{2}\%$ of \$480
8. $6\frac{1}{4}\%$ of \$320
9. $87\frac{1}{2}\%$ of \$800
10. 100% of \$326
11. $83\frac{1}{3}\%$ of \$300
12. 70% of \$600
13. 40% of \$300
14. $37\frac{1}{2}\%$ of \$240
15. 60% of \$200
16. $62\frac{1}{2}\%$ of \$160
17. $8\frac{1}{3}\%$ of \$120
18. 90% of \$800
19. 80% of \$200
20. 500% of \$200

WRITTEN EXERCISE

In the drill above, you employed the common fraction equivalent. In many cases it is not possible to do this.

1. The population of a town which contained 5650 persons was increased 8% by the erection of a large factory. Find the population after this increase:

```
  5650
  1.08
------
 452.00
5650.0
------
6102.00
```

Here you use decimals. Explain why you multiply by 108% or 1.08. State the rule for finding the per cent.

Find the results:

2. 14% of 54
3. 36% of 78
4. 93% of 85
5. 112% of 560
6. 68% of 212
7. 3% of 2675
8. $7\frac{1}{4}$% of 2400
9. 78% of 1440
10. $16\frac{1}{2}$% of 3620
11. 47% of 9700
12. 38% of 1410
13. 342% of 3000
14. $30\frac{1}{2}$% of 5600
15. 19% of 780
16. $24\frac{1}{2}$% of 3200
17. 21% of 7000
18. 71% of 3690
19. 105% of 5100
20. $\frac{1}{4}$% of 20,000
21. $\frac{1}{2}$% of 1000
22. $\frac{3}{4}$% of 12,000
23. 203% of 6000
24. 88% of 15,000
25. 93% of 16,300

WRITTEN PROBLEMS

Use decimal or common fractions:

1. The wear and tear on a trolley car reduces its value 12% in a year. If a car costs \$5400, what is it worth after a year of service?

2. A dealer, having \$1260 to invest, spent 25% of it for cloth at 75¢ a yd. How many yd. did he buy?

3. An auctioneer sold the furnishings of a house for \$7224. If his charges were 5%, how much did the owner of the furniture receive?

4. $12\frac{1}{2}$% of 196 ft.
5. 15% of 3000 yd.
6. 20% of 390 mi.
7. $14\frac{2}{7}$% of \$4900
8. 30% of \$960
9. $\frac{1}{2}$% of \$6200
10. $37\frac{1}{2}$% of \$4800
11. 45% of 280 ft.
12. 5% of \$7000
13. $7\frac{1}{2}$% of \$6200
14. 75% of \$3200
15. 65% of \$1500

16. A large school contains 4350 pupils. If 54% of the pupils are boys, how many boys are there?

17. A man sold an automobile that had cost him $3875. He bought another that cost him only 70% as much as the first. How much did the second car cost?

18. During one week, 18,400 people attended a theatre. The next week the attendance fell off 14%. How many people attended during the second week?

19. An orchard yielded in one season 3850 bu. of apples. 8% of them were not fit for packing. How many bu. were packed?

20. Sets of furniture originally marked $125.40 were reduced 15%. What was the reduction? the selling-price?

21. A man who receives $3500 a year saves 38% of it. At this rate how much will he save in six years?

22. A dealer bought 640 pairs of shoes. He sold 35% of them at $5.20 a pair and the remainder at $6.00 a pair. What will he get for the shoes?

23. A man borrows $2300 from a bank, and is charged 6% for the use of the money. At the end of the year, he repays the loan. How much did the loan cost him?

24. A grocer invested $8450 in a new store. At the end of a year, his profit figures 14½% on his investment. What did he gain?

To Find the Rate: What Per Cent One Number is of Another.

What per cent of 48 feet is 6 feet?

$\frac{6}{48} = \frac{1}{8} =$
$8)\underline{1.00}$
$.12\frac{1}{2} =$
$12\frac{1}{2}\%$

The distance is $\frac{6}{48}$ of the entire distance. What is the rule for changing a common to a decimal fraction?

ORAL EXERCISE

1. Of 24 problems a boy worked 8. What per cent of the total did he work?

2. Out of a total of 72, a pupil was absent 12 days. What per cent was he absent?

3. From a shipment of 350 automobiles, an agent bought 50. What per cent of the shipment did he buy?

What per cent of:

4. 48 is 12? 72 is 9? 45 is 45? 54 is 9? 72 is 6?
5. 90 is 15? 49 is 7? 60 is 15? 64 is 8? 24 is 8?

WRITTEN EXERCISE

What per cent of:

1. 90 is 45?
2. 105 is 35?
3. 1200 is 60?
4. $24.10 is $2.41?
5. 400 is 160?
6. 450 is 225?

7. A clerk earns $1200 a year. What per cent of his salary does he save if he spends all but $340 a year?

8. What per cent is taken off a bill of $15 if 90¢ is deducted?

9. What per cent of a yard is an inch? A foot?

10. A dealer drew two pints from a ten gallon can of milk. What per cent did he draw?

11. An owner carries $35,000 insurance on a building worth $105,000. For what per cent of its value is the building insured.

12. What per cent of 5 lb. is $7\frac{1}{2}$ oz.?

13. During the season, a baseball club won 60 games and lost 36. What per cent of the games played was won?

To Find a Number when a Part is Given: To Find the Base.

A boy spent 15 cents, which was 60% of his money. How much money did he have originally?

$60\% = \frac{3}{5}$

As *three* fifths of all his money was 15 cents, *one* fifth was $\frac{1}{5}$ of 15 cents, or 5 cents; *five* fifths, or *all* his money, was 5 times 5 cents, or 25 cents.

ORAL EXERCISE

Find the whole number:

1. If 25% of it is 31
2. If 50% of it is 57
3. If $62\frac{1}{2}\%$ of it is 60
4. If $12\frac{1}{2}\%$ of it is 72
5. If $14\frac{2}{7}\%$ of it is 22
6. If $\frac{1}{2}\%$ of it is 35
7. If 25% of it is 82
8. If 150% of it is 66
9. If 200% of it is 44
10. If 75% of it is 24

11. From two classes in a school 72 pupils were promoted. How many pupils were in the classes, if this number was 75% of the total number of pupils in those classes?

12. A farmer paid $65 on a hardware bill. If this was $62\frac{1}{2}\%$ of the total amount that he owed, what was the amount of the bill?

13. After having traveled 21 miles, a chauffeur found that he had gone 30% of his trip. How many miles would there be in the whole trip?

14. After he had printed 1400 calendars, a stationer found that he had finished $87\frac{1}{2}\%$ of an order. How many calendars were ordered?

WRITTEN EXERCISE

1. Find the number of which \$39.69 is 9%:

.09) \$39.69 \$441.

This shows the shortest method of doing the work.

Analyze as you did in the oral examples above. What is the rule for multiplying decimals?

Find the whole number:

2. When 28 per cent of it is 1008
3. When 42 per cent of it is 43.47
4. When 15 per cent of it is 225
5. When 120 per cent of it is 384
6. When 36 per cent of it is 612
7. When 140 per cent of it is 700
8. When 90 per cent of it is 981
9. When 16 per cent of it is 29.6

10. An elevator carried a total weight of 5270 lb. If this is 62% of the car's capacity, how many pounds can it carry?

11. Find the number which, when increased by 25% of itself, equals 250:

As 250 equals a number increased by 25% of itself, 250 equals 125%, or $\frac{5}{4}$ of the number.

12. A clerk's salary was increased to \$36 a week. If this was an increase of 20%, what was the salary before the raise?

13. What number decreased by 35% equals 806?

As the number is decreased by 35%, 806 must equal 65% of the number.

14. The contents of a storage house were damaged by fire and sold for \$8476, which was 48% less than the original value. Find the original value.

15. An automobile was sold for \$782. This was an increase of 15% on the cost. What did the car cost?

PROFIT AND LOSS

Before a business man can determine whether he is making a profit or suffering a loss on a line of goods, he must take into consideration the expenses connected with buying and selling those goods. He pays rent and taxes; he pays for light, heat, and power; he pays wages to employees; he pays for insurance on the goods; he generally pays for advertising and delivering the goods.

These expenses, outside the first cost of the goods, are called "overhead charges"—in the hurry of business phraseology, "**overhead.**" The business man takes them all into consideration together with the buying cost, and the total forms his actual cost, or "**cost.**" Upon this cost, he bases his selling price—unless that be fixed by causes outside of his own immediate control.

Profit or loss is estimated upon the total cost—that is, upon the primary cost plus the "overhead."

ORAL EXERCISE

1. It cost \$1.20 to manufacture a book. For how much must the book be sold to gain 20%?

2. A hat that cost \$8 to make was sold for \$11. What is the per cent of profit?

3. A boy sold a bicycle at a profit of \$4. If this was $16\frac{2}{3}\%$ of the cost of the wheel, how much did it cost?

4. A dealer sold a set of furniture at a loss of \$60. This loss was exactly 75% of the cost. What was the cost? What was the selling price?

Find the gain or loss, and the selling price:

	COST	RATE		COST	RATE
5.	$ .80	25 % loss	10.	$ 1.00	75 % gain
6.	5.00	60 % gain	11.	30.00	40 % gain
7.	24.00	33⅓% gain	12.	6.30	100 % gain
8.	40.50	50 % loss	13.	50.00	20 % loss
9.	.90	10 % loss	14.	24.24	6¼% gain

Find the gain or loss per cent:

	COST			COST	
15.	$ .75	$ .25 gain	20.	$ .49	$ .07 loss
16.	6.00	1.00 gain	21.	.45	.05 gain
17.	35.00	5.00 loss	22.	60.00	20.00 gain
18.	100.00	4.00 loss	23.	18.00	2.00 loss
19.	2.50	.50 gain	24.	4.50	1.50 gain

WRITTEN EXERCISE

1. A real estate agent sold at a gain of 15% a house that had cost $22,000. What was received for the house?

2. A department store manager estimated that the overhead charges involved in selling goods that had cost $2448.40 were $245.36. If the profit on those goods was 12½%, what was the amount gained?

3. A business man plans to make a profit of 10% on dry goods. The goods cost $3765.20. If the selling charges are $415, at what price must he sell the stock?

4. After a fire, a shoe merchant found that his stock, worth $11,840, had been damaged 30%. What was the amount of his loss?

5. A storekeeper paid \$2280 for a stock of goods. The selling charges amounted to \$342.50. The line of goods was sold out, at a loss of 6%. What was the loss?

6. A man sells two horses at \$100 each. On one he gains 25% and on the other he loses 20%. Does he gain or lose on the transaction? How much?

7. An investor, who had paid \$8360 for a lot, found that its value increased 42% in a year. How much was it worth at the end of the year? What was the gain?

8. A dealer buys a barrel of syrup for \$20. What ought he to charge per gal. in order that he may gain 20%?

There are $31\frac{1}{2}$ gal. in a bbl. Allow $1\frac{1}{2}$ gal. for the waste in selling at retail.

9. An investor bought a farm for \$6800. He spent \$2240 in building a house and \$480 for a garage. Later, repairs and painting cost him \$850. At what price must he sell if he wishes to make a profit of 12%?

10. A dealer bought 800 tons of ice for \$1800. He sold the ice at the rate of 30¢ per 100 lb. Allow 25% for "overhead" and melting of ice. What did he gain? What was his per cent of gain?

11. A dealer bought 10 pieces of cloth containing 35 yards each for \$28. His "overhead" was 10%. He sold the goods at retail at $12\frac{1}{2}$¢ a yard. What was his gain? The per cent of gain?

12. A grocer sold 15 bu. of potatoes at 60¢ a bu., thereby gaining \$2.25. What was the rate per cent of gain?

13. A victrola is sold for \$90 at a loss of $16\frac{2}{3}$%. What had been paid for it?

14. An agent sold a factory for \$16,000, at a loss of 20%. What was the cost?

15. A lamp sells for \$1.29. If the profit is 50%, what was the cost?

16. A farmer sold a threshing machine at a profit of \$64. This profit was 16% of the cost. For what did he sell? What was the cost?

You now understand the theory underlying the computing of profit and loss. In all your work you have considered that *the cost is the base* upon which to compute the percentage.

You understand that, in large business houses, one must always consider cost as the total of primary cost plus the "overhead."

But, you will also learn, if you go into the accounting departments of the largest houses, that these houses no longer consider the cost the base upon which to figure the per cent of profit and loss.

Competition is so intense; so much business is done upon so very narrow a margin; so great a proportion of that business is done upon a commission basis, where payment is always figured upon the selling price, that it is becoming the custom to consider *the selling price the base* upon which to figure the per cent of profit and loss.

But remember, if you should work in a business man's office, that the employer, not the clerk, is the proper judge of the method to be used.

Compare the two methods	Cost, \$5; S.P., \$5.50
Base = Cost	Base = S.P.
\$5.50	\$5.50
−5.	−5.
.50 = Gain	.50 = Gain
5) .50	5.50) .5000
.10	$.09\frac{1}{11}$
10% = Gain	Gain = $9\frac{1}{11}$%

COMMISSION

Tradesmen, such as butchers, grocers, etc., are said to sell goods at **retail.** Producers, like farm managers, heads of factories and mines, of course seldom sell at retail but ship their products to cities where agents handle them for the producers. These agents sell the products at the current **wholesale** prices. Sometimes they send out salesmen who show samples and take orders, each salesman having a certain territory, or section of the state or country, in which to sell.

The agents who receive the goods and sell them for the producers are called **commission merchants** and they receive for their services a percentage of the sales that they are able to make. This money is called **commission.** The salesmen receive salaries and generally a commission on their sales as well.

For example: A farm manager sends produce to his city agent. The agent sells the produce for $842.50, deducts from the amount his commission of 4%, and sends to the manager a check for $808.80. The amount that he retains for his services, $33.70, is called his **commission;** the amount that he sends to the owner, $808.80, is called the **net proceeds,** or simply **proceeds.**

The person for whom the business is transacted by the agent is called the **principal** or the **consignor.** The merchandise to be sold is called the **shipment** or the **consignment.** The agent to whom consignment is shipped is called the **consignee.**

Commission agents also buy goods for business men and receive for their services a percentage of the amount spent. Real estate agents buy and sell houses and lots in the city, and farms in the country, on commission. Other agents buy and sell stores, established businesses, factories, cattle, and automobiles, on commission. These agents are sometimes called **commission brokers** and their commission is called **brokerage.**

ORAL EXERCISE

Find the amounts of these commissions:

1. A broker sold 15,000 lb. beans @ 4¢ a lb. on a commission of 3%.
2. A canvasser sold 400 magazine subscriptions @ $2 each, on a commission of 5%.
3. A bank solicitor obtains deposits amounting to $12,000 on a commission of 6%.
4. An insurance agent writes policies amounting to $10,000 on a commission of 8%.
5. An attorney collected a bill of $560 on a commission of $12\frac{1}{2}\%$.

WRITTEN EXERCISE

1. An agent sold a house and lot for $7500. What was his commission at $2\frac{1}{2}\%$? How much did the owner get?
2. I paid 9% commission on the sale of an automobile for $2750. How much did I receive for the car?
3. A collection agency charges $16\frac{2}{3}\%$ commission. If it collects debts amounting to $654, how much will the creditor receive?
4. A ship broker received a commission of $\frac{5}{8}\%$ for aiding in the sale of a steamer worth $165,000. What was his commission?

5. An agent sold 32 wagons at $175 each. What were the net proceeds if his commission was 4%?

6. A collector secures the payment of 80% of a debt of $2400. If his commission is 4½%, how much should he remit to his principal?

Find the commission:

	SALE OR PURCHASE	RATE		SALE OR PURCHASE	RATE
7.	$2400	6 %	11.	$12000	5¾%
8.	8620	12 %	12.	8600	2½%
9.	3580	4½%	13.	2480	7¼%
10.	2800	6¼%	14.	18600	12½%

15. I sent an agent 350 boxes of grapefruits which he sold at $2.50 a box. His charges were: commission, 3%; storage, 1%; cartage, $10. How much was due me?

16. A salesgirl receives $9 a week and 1½% commission on all her sales. If she sells $324 worth of goods in a week, what is her income that week?

17. A magazine agent receives 15% commission on all subscriptions. How much does he earn by securing 5 subscriptions at $3, 9 at $2.50, and 24 at $2?

18. Find the total commission in these sales: $4800, ⅛%; $5600, ½%; $6400, ¾%; $5000, ⅕%.

19. An agent bought 1200 doz. eggs for a dealer at 24¢ a doz. and charged a commission of 3½%. What was the total cost to the dealer?

20. An employment agency charges a commission of 10% on the first month's salary, and 5% on the salary of the three succeeding months. How much must a bookkeeper pay the agency for securing him a position at $88 a mo.?

21. My agent sold goods for me to the amount of $2650. If he paid $85 for cartage and other expenses and charged 3% commission, what were the net proceeds?

22. What are the net proceeds of a sale of 225 bbl. of beef @ $15.25, allowing 2% commission and 5¢ a bbl. for storage?

23. How much did a broker receive for purchasing 84,000 lb. coffee for an importer @ 18¢ a lb., brokerage $\frac{1}{4}$%?

24. A traveling salesman receives a salary of $28 a week and $1\frac{1}{2}$% commission on his sales. If his sales amount to $95,000 a year, what is his yearly income?

25. A real estate agent receives a commission of 5% on all rents that he collects. He has 10 houses rented at $35 a mo., 6 at $40, 3 at $28, 1 at $25, 5 at $37.50, and 3 at $42. What are his commissions for a month? What is his total commission?

26. An agent receives $541.62 to pay for a purchase of flour. How much flour can he buy at $4.50 a bbl., after deducting his commission of 2%?

27. A collector secured the payment of 60% of a debt of $5200 and charged $3\frac{1}{2}$% commission. How much should he return to his employer?

28. A broker bought mining stock valued at $1780, charging $\frac{1}{8}$% commission. How much did the stock cost and what was the agent's commission?

29. A farmer sent an agent 400 bbl. potatoes which were sold at $3.50 a bbl. The agent charged $1\frac{3}{4}$% commission, 1% storage, and $4.50 cartage. How much did the farmer receive?

ORAL EXERCISE

1. What rate of commission do I pay if I allow \$40 for the sale of an automobile for \$320.

2. An agent rented a store for \$4800 a year. If he receives a commission of \$240, at what rate is he paid?

Find the rate of commission:

	SALE	COMMISSION		SALE	COMMISSION
3.	\$400	\$80	8.	\$500	\$ 25
4.	\$80	\$4	9.	\$1200	\$120
5.	\$3000	\$50	10.	\$810	\$ 90
6.	\$240	\$40	11.	\$480	\$60
7.	\$800	\$40	12.	\$350	\$50

WRITTEN EXERCISE

1. An agent sold a factory for \$22,600. He received \$1130 commission. At what rate was he paid?

2. A piano salesman received a commission of $12\frac{1}{2}\%$. What was the value of his sales if he received \$528?

3. A lawyer secured a judgment of \$7400 against a railroad company for injuries to his client. If the lawyer received 24% for his services, how much was left for the client?

4. A commission merchant sold California fruit for \$1240 and sent the shippers \$1184.20 as the proceeds. What was the rate of commission?

5. An agent sold two tugboats, one for \$12,000 and the other for \$14,600. What rate of commission did he charge, if he received \$1197?

6. An agent received \$325 by selling furniture on commission. If his rate of commission was 2%, what was the value of the goods that he sold?

7. An agent received 5% for selling an automobile. His commission was \$116. What was the selling price?

8. An estate paid a real estate agent a commission of \$850.50 for selling property. If the rate of commission was $3\frac{1}{2}$%, what was the selling price?

9. A cocoa-bean broker sold 400 bags of Bahia beans, each bag containing 200 lb. at 20¢ a lb. What was his commission at 6%?

10. An agent sold one piece of property for \$7800 on a commission of 3%, and another piece for \$11,400 on a commission of 2%. Which transaction was the more profitable for him and by how much?

11. A real estate dealer earned \$6000 in commissions. If he was paid at the rate of $2\frac{1}{2}$%, what was the value of the properties that he sold?

12. What are the net proceeds on the sale of 76 bbl. of flour @ \$7.50 a bbl., the commission being $3\frac{1}{2}$% and the freight and storage 33¢ a bbl.?

13. A salesman sold 40 chairs at \$7.50 each and 16 tables at \$18 each. Find the rate of commission, if he received \$7.35.

14. An agent rents a store for \$62.50 a month, and sends in a bill for \$2.50 commission. What was the rate?

15. Through an agent, a merchant buys 640 yd. carpet @ 75¢ a yd. and pays $\frac{3}{4}$% commission; the freight bill is \$2.80. What is the lowest price per yd. at which a merchant can sell the carpet without loss?

Find the Amount of Sale:

	COMMISSION	RATE		PROCEEDS	RATE
16.	$106.25	2½%	21.	$9800.00	2 %
17.	812.50	3¼%	22.	33.95	3 %
18.	1.02	4 %	23.	878.60	4½%
19.	1125.00	1½%	24.	141,000.00	6 %
20.	11.65	5 %	25.	29.97	3 %

INSURANCE

Business men obtain compensation for sudden losses, such as arise from fires, accidents, etc., by insuring their buildings and their stock. Many business men insure themselves—and even their employees against the accidents that may happen to *them* while at work, or because of the work. The companies that sell **insurance**, as it is called, charge the business man a small annual fee for the service. For example: $72 may be charged to insure Mr. A's store, worth $9000. As the companies get the small fees from a great number of persons, and as there occur but a comparatively small number of fires every year, they are able, without inconvenience, to pay to the insured, say Mr. A, the relatively large sum of $9000, should his store be burned.

There are many kinds of insurance. The most common kinds are: fire, life, accident, and marine insurance. There are, besides, many special kinds of insurance to protect a man and his business in practically every contingency that may arise.

When a man joins an insurance company, the company, by a written contract, promises to pay him a definite sum

in case of loss. This contract is called a **policy**. The specified sum to be paid him in case of loss is called the **face of the policy**. The annual fee to be paid to the company by the man insured is called the **premium**. This is usually given as a certain rate for each \$100 of the face of the policy. If the rate is 80¢, then for every \$100 of the face of the policy the person insured must pay the company an annual premium of 80¢. On \$9000 the premium would be $90 \times \$.80$ or \$72. The rate of insurance depends upon conditions. Excellent conditions cause a low rate; dangerous conditions, a high rate.

ORAL EXERCISE

State amount of premium quickly:

1. When face of policy is \$8000 and rate $37\frac{1}{2}$¢.
2. When face of policy is \$10,000 and rate \$2.10.
3. When face of policy is \$9500 and rate \$1.25.
4. When face of policy is \$14,000 and rate 90¢.
5. When face of policy is \$3000 and rate $66\frac{2}{3}$¢.

WRITTEN EXERCISE

1. What is the annual premium on a policy for \$4500 if the rate is \$.85?
2. A house is insured for \$8200 at rate of \$1.05. What is the premium?
3. A building, valued at \$75,000, was insured for $\frac{4}{5}$ of its value at \$1.50. What was the premium?
4. If you insure the contents of a store for \$14,000, what is the premium, if the rate is \$1.40?
5. A house was insured at 90¢. If the premium was \$85.50, what was the face of the policy?

DISCOUNTS

A **Discount** is an amount deducted or to be deducted from a stated sum or price. It is usually indicated by a rate per cent.

Manufacturers of clothing, sporting goods, shoes, machinery, etc., publishers of books, and wholesale dealers in groceries, meat, and other food products issue catalogues and price lists of their merchandise. The prices given in these lists are called **list prices.**

As it is quite impracticable for producers and dealers, from the standpoint both of time and expense, to bring out new lists every time the prices of their goods change, they usually print the list prices in the catalogues at rates higher than any market prices likely to prevail; and they regulate the prices actually to be charged to their customers by designating from time to time certain **discounts** from those list prices. These discounts, generally in the form of lists, are mailed to customers. If the market price goes up, a smaller discount is granted; if the price drops, a larger discount. The manufacturer may adjust these differences in prices by allowing a second discount, or a series of discounts, deductible in turn.

Discounts from list prices are called **trade**, or **commercial, discounts.**

Discount may be given also for payment made before a bill is due. Wholesale dealers usually allow the customer 30 da., 60 da., or 90 da., in which to pay a bill. If the customer pays for the goods upon delivery, or pays within 10 da., he may be allowed a **discount for cash** of 2% or 5%.

The **net amount** of a bill is the sum to be paid after the discounts have been deducted. Compose a definition for **net price.**

For example: A tennis club orders 7 " Domino " model tennis rackets. The list price is $5. The discount allowed is 20%. A second discount of 2% is given because the bill is paid in four days.

$35.00 = the first price
7.00 = the first discount, 20% of $35
$28.00
.56 = the second discount, 2% of $28
$27.44 = the **Net Price**

The second discount is based upon the amount remaining after the first discount has been deducted.

The order in which the successive discounts are deducted does not affect the result.

ORAL EXERCISE

Find the net cost of the following:

	LIST PRICES	DISCOUNTS		LIST PRICES	DISCOUNTS
1.	$240	12½%	6.	$5.50	20%
2.	$1600	25%	7.	$88.40	50%
3.	$700	40%	8.	$1000	10% and 2%
4.	$400	10% and 2%	9.	$1200	10% and 1%
5.	$8000	5% and 2%	10.	$5000	20% and 4%

WRITTEN EXERCISE

1. Find the net cost of an automobile listed at $2250, at 15% discount.

2. Ladies' suits in a store are marked "$38.40 less 20%." What is the net price?

3. What is the net price of 2½ doz. electric lights at $16 per doz., discount 12½%?

4. The list price of a stove was $45, but discounts of 10% and 5% were allowed. What was the selling price?

5. What is the net price of a rowing machine marked to sell at $85.50, less discount of 8% and 4%?

Find the net prices of the following amounts after deducting the discounts:

6. $700, 3½%
7. $150, 10%, 2%
8. $760, 8%, 5%
9. $480, 10%, 5%
10. $275.50, 8%
11. $684.20, 3%

12. A typewriter listed at $72 is bought for $63.36. What is the rate of discount?

13. How much greater is a discount of 25% on $3200, than a discount of 20% and 5%?

14. A storekeeper buys an average of $6500 worth of goods each month. How much does he save every year by taking advantage of a 2% discount for cash?

15. A merchant bought goods listed at $1472 and was allowed discounts of 12½% and 10%. How much did he pay for the goods?

16. An automobile delivery truck was sold for $3800, less 12½% and 10%. What was the selling price?

17. Which costs more and how much: a table marked $16.50, with a discount of 20%, or one marked $11.75 without discount?

18. A set of office furniture was listed at $620, less 20% and 12½%. What is the net price?

19. What is the difference between a straight discount of 10%, and two successive discounts of 5% each, on a bill of $832?

20. What is the rate of discount when a victrola listed at $200 sells for $170?

21. What is the cost of 15 doz. hammers, listed at $9 a doz., with discounts of 40%, 20%, and 10%?

22. A dealer bought goods listed at $2300. The net amount of his bill was $1840. Find the rate of discount that he was allowed.

TAXES

Meaning of Taxes. A tax is a compulsory contribution of property, levied by government, and is generally paid in the form of money, to be expended for the uses of government—town, city, county, state, general, etc., as the case may be.

For purposes of taxation property is classified as:

1. **Real Estate,** comprising land and buildings;

2. **Personal Property,** which includes money, stocks, clothing, furniture, objects of art, jewelry, utensils, horses and other animals, automobiles, aeroplanes, boats, etc., etc.

A city, let us say, must expend yearly large sums to maintain police, fire, and health departments; to support schools, hospitals, parks, and prisons; to pay salaries of city employees, and for pensions; to build and to clean roads and streets; and also to pay the city's compulsory contribution levied by the state and the federal governments. New York City needs over $200,000,000 a year to pay its bills; Philadelphia about $60,000,000.

How we are Taxed. Certain officials of the government, a town, for instance, estimate how much money will be needed to meet all the expenses for one year. Then other officials, called **assessors,** inspect all the real estate in the

town, placing a value on each parcel. Having thus **assessed** all of the real estate and determined the total **assessment** for the whole town, they divide by that total the sum to be levied. The result, say 3.70, or 1.78, or .83 is the **tax rate;** that is, for every $100 worth of each person's assessed property he must pay a tax of $3.70, or $1.78, or $.83. If a personal tax is also to be levied, persons owning or supposed to own certain kinds of personal property are compelled to make written statement, under oath, regarding the property and the value thereof. The total assessed value of the personal property would also enter into the calculation to determine the tax rate.

The Tax Rate. A man may own an apartment house that is assessed at $44,000. If the tax rate is $1.75 on every $100, he pays a tax of $770. The tax rate, then, is really a percentage, in this case $1\frac{3}{4}\%$: it is usually expressed as so many mills or so many cents on each dollar's worth of property, as $1\frac{1}{2}¢$ on $1.00; or as so many dollars on each one hundred dollars' or one thousand dollars' worth, as $1.75 on $100, or $17.50 on $1000.

How Taxes are Shared. Each person in the community must bear his share of the taxation. A man may own no real estate in the town, but if his landlord has to pay a heavier tax next year, the man must pay more rent; and must pay more for his meat, groceries, clothing, etc., because of the higher rents or taxes levied on the tradesmen, etc.

Property owned by a hospital which is used for the public benefit, and also church property, as well as all property owned by the city, is generally exempt from taxation.

An income tax is a tax levied upon all incomes which exceed a certain fixed amount.

WRITTEN EXERCISE

1. Find the tax on property assessed for \$3600, if the tax rate is $1\frac{3}{4}\%$.

2. A lot is assessed for \$12,400. If the tax rate is \$1.35 on \$100, what is the amount of the tax bill?

Find the taxes on the following:

	VALUE	TAX RATE		VALUE	TAX RATE
3.	\$12,000	\$2.12 per \$100	8.	\$7700	\$1.35 per \$100
4.	\$10,000	$1\frac{3}{5}¢$ on \$1	9.	\$11,000	\$2.25 per \$100
5.	\$9000	\$1.78 per \$100	10.	\$24,500	\$20.08 per \$1000
6.	\$8800	\$1.90 per \$100	11.	\$15,000	12.3 mills on \$1
7.	\$32,000	15 mills on \$1	12.	\$26,600	\$21.40 per \$1000

Municipal Taxation: New York City as a Type. The cost of running New York City for one year is over \$200,000,000. This sum is divided among different city departments and activities:

Interest Charges and Payments on City Debt,	\$53,000,000
Educational Work,	41,000,000
Departments Protecting Life and Property,	33,000,000
Health and Sanitation,	18,000,000
Expenses of City Courts and Prisons,	11,000,000
Charity,	10,000,000
State Taxes, Rents, and Pensions,	17,000,000
Care of Streets and Bridges,	7,000,000
Salaries of Officials,	4,000,000
Parks and Museums,	4,000,000
Docks and Ferries,	3,000,000
Public Buildings and Offices,	2,000,000
	\$203,000,000

Raising the Money for Expenses. New York City taxes real estate and personal property. The city territory measures 315 square miles; 5,700,000 people live within its limits. In a recent year, the assessed value of all the property taxed, was $8,390,000,000. This was divided among the five boroughs as follows:

BOROUGH	SQ. MI.	ASSESSED VALUES	TAX RATE
Manhattan	21	$5,400,000,000	$1.78
The Bronx	40.6	664,300,000	1.77
Brooklyn	77.6	1,720,000,000	1.84
Queens	118.6	495,000,000	1.80
Richmond	57.2	84,000,000	1.90

WRITTEN EXERCISE

1. A company owns electric power plants in the several boroughs of New York City. Using the borough tax rate, find the taxes for each borough, if the property in each is assessed as follows:

Manhattan	$814,200	Bronx	$770,500
Brooklyn	$910,000	Queens	$202,100
	Richmond	$66,800	

2. H. A. Horton owns a house and lot in Queens Borough worth $28,000. If the assessed value is 75% of the actual value, how much tax does he pay?

3. If the tax rate is 18 mills, what is the amount of the tax on a theatre assessed at $48,400?

4. Find the tax rate on a piece of property in Brooklyn valued at $8200, if the tax paid is $150.88.

5. A milk company owns plants in Manhattan assessed at $235,000, property in the Bronx assessed at $185,200, and property in Brooklyn assessed at $217,500. What is the total amount of taxes for the year in all three boroughs?

6. The tax assessed on a garage valued at $12,500 is $181.25. What is the tax per $1000?

7. A man's property was assessed at $9500. What is the tax bill at $2.08?

8. When the tax rate is $1.85, what amount must be paid on property assessed at $7100?

9. A man received a tax bill for $371. If his property was assessed at $21,200, what was the tax rate for that year?

10. What is the tax on a factory worth $124,000 which is assessed for 80% of its valuation, at 18 mills?

11. A property owner, in whose city a tax of $4.65 per hundred is levied, owns a house worth $7600. What will his tax bill be?

12. If the amount of the tax on property assessed at $18,400 is $230, what is the tax rate?

13. One year, the tax rate in a city was $1.04. The next year, it was raised to $1.17. What was the increase in taxes on property assessed at $44,800?

14. Find the amount of the taxes on a house worth $12,000, assessed at $\frac{4}{5}$ valuation, the rate being $1.15 per hundred.

15. When the tax rate is 2.12%, what will be paid in taxes on a piece of property assessed at $15,400?

16. What is the tax on property assessed at $22,500 at the rate of $4\frac{3}{4}$ mills?

17. A piece of property valued at $18,500 is assessed at $\frac{4}{5}$ of its value at $2.12 per $100. What is the amount of the tax bill?

Philadelphia as a Type. The City of Philadelphia taxes real estate only, which is assessed as nearly as possible at its full value.

There are three rates of taxation: the **city tax**, which is $1.50 on each hundred dollars; the **suburban tax,** which is $1.00 on each hundred dollars; and the **farm tax,** which is $.75 on each hundred dollars.

In other words, the taxation rate is not the same for all parts of the city, but decreases towards the out-lying districts. The tax rate is regulated in this way because the residents of the suburban districts neither receive nor need as much police, fire, and health protection as those living in the heart of the city. Residents in the farm districts benefit even less from the expenditure of the city money so their share of the taxation is still less.

Poll Tax. Male citizens over 21 years of age who do not pay taxes on real estate or personal property are charged a **poll tax.** In Philadelphia, this tax is $.50, levied every two years.

Pennsylvania levies a **state tax** on personal property of four mills on the dollar.

WRITTEN EXERCISE

1. A man's property in Philadelphia is assessed $8800. What are his annual taxes at the city rate?

2. A company's store is assessed at $14,000, taxable at city rate, and their factory at $4700, rural rate. How much taxes are paid annually?

3. A man owns a city residence assessed at $9400. His brother's country house is assessed at $11,800. Which one pays the larger tax bill and by how much?

4. A milk depot is assessed at $7800. What is the amount of the taxes at the suburban rate? For early payment a discount of 1% is allowed. What is the net amount of the bill?

5. Henry Robbins owns a city house assessed at $9500, and a country house assessed at $5250. At $1.50 city rate and $1.00 rural rate, what is his tax bill?

6. A real estate company owns three plots of land, one in the city assessed at $22,000, another in the suburbs assessed at $7000, and a third assessed at $16,400, farm rate. What is the total amount of the taxes for the year?

7. A property owner's tax bills for the last five years were $370.10, $384.20, $295.05, $377.40, $369.25. By paying these within the time limit of two months, he secured a 1% discount. What amount did he save?

8. What is the amount of taxes on the following properties at city rates; at suburban rates; at rural rates?

$7,000	$28,000	$62,400	$105,000
$12,500	$35,000	$75,000	$124,000

9. A company owns three parcels of land in three different cities: one parcel is assessed at $25,000; another is assessed at $8500; a third is assessed at $50,000. If the tax rates in these cities are respectively $1.77, $1.80, and $1.84 per $100, what is that company's total tax?

10. What is the tax rate in a certain city if the tax is $66.30 on a piece of property assessed at $4250?

11. If the tax rate in a certain town is $1.26 per $100, what should a man pay whose house is assessed for $6500 and his factory for $12,500?

12. If the tax on $3500 is $64.75, what is the rate?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	3 ft. = ? in.	3×24	? ft. = 1 mi.	? ft. = 1 rd.	8×51
2.	3 gal. = ? qt.	5×36	? pt. = 1 gal.	12 qt. = ? pk.	7×62
3.	5 T. = ? lb.	7×42	32 qt. = ? bu.	$\frac{1}{2}$ mi. = ? rd.	9×32
4.	12 oz. = ? qt.	9×25	640 rd. = ? mi.	1 cwt. = ? oz.	6×41
5.	$\frac{3}{4}$ hr. = ? min.	8×33	8 cwt. = ? lb.	25 gal. = ? qt.	4×53

Find gain or loss per cent when:

	Cost =	Gain =	Cost =	Loss =			
6.	$80,	$10	$42,	$6	22.3 ÷ 100	55 ÷ ? = 11	$\frac{3}{11}$ of 44
7.	$35,	$35	$64,	$40	40.8 ÷ 100	76 ÷ ? = 19	$\frac{7}{8}$ of 48
8.	$48,	$4	$32,	$8	543 ÷ 100	14 ÷ ? = 7	$\frac{4}{9}$ of 81
9.	$20,	$20	$24,	$2	79.1 ÷ 100	42 ÷ ? = 14	$\frac{5}{6}$ of 54
10.	$100,	$30	$60,	$10	234 ÷ 100	51 ÷ ? = 17	$\frac{2}{13}$ of 39

In following, of what number is:

11.	20,	50%	8,	100%	30, 75%	2.23×100	$\frac{3}{14}$ ÷ 3
12.	15,	75%	4,	$12\frac{1}{2}$%	24, 80%	10.7×100	$\frac{2}{9}$ ÷ 3
13.	20,	40%	41,	50%	12, $37\frac{1}{2}$%	5.46×100	$\frac{?}{12}$ = 6
14.	7,	20%	6,	$14\frac{2}{7}$%	25, $62\frac{1}{2}$%	.924×100	$\frac{?}{6}$ = 5
15.	17,	$33\frac{1}{3}$%	9,	300%	16, $66\frac{2}{3}$%	7.13×100	$\frac{?}{17}$ = 3

16.	$\frac{1}{2}$ gr. = ?	4×27	$\frac{3}{4}$ doz. = ?	? + 9 = 34	5×15
17.	$49\frac{1}{2}$ ft. = ? rd.	7×61	? A = 1 sq. mi.	? − 37 = 4	7×13
18.	? in. = 1 yd.	9×35	$4\frac{1}{2}$ hr. = ? min.	38 ÷ ? = 19	8×15
19.	1728 cu. in. = ?	8×43	144 sq. in. = ?	16×? = 80	9×22
20.	2 cu. yd. = ? cu. ft.	6×51	9 sq. yd. = ? sq. ft.	108 ÷ ? = 9	11×11

21.	$1.48 + $.58	8.75 ÷ 10	$5.46 − $.54	2.6×10	3.45 ÷ .01
22.	2.76 + .62	2.6 ÷ 10	3.19 − .37	.28×10	27.3 ÷ .01
23.	3.14 + .39	3.61 ÷ 10	2.74 − .85	3.16×10	4.86 ÷ .01
24.	2.19 + .71	.28 ÷ 10	1.84 − .96	.075×10	.045 ÷ .01
25.	3.47 + .57	.075 ÷ 10	3.26 − .32	8.75×10	.009 ÷ .01

GENERAL WRITTEN PROBLEMS

1. At Thanksgiving time, a merchant sold 40,000 lb. of turkey at 37¢ a pound. What was the amount of his commission at 2%?

2. A room has a hardwood floor 12 ft. by 15 ft., partly covered by a rug 9 ft. by 12 ft. At 2½¢ a sq. ft., what is the cost of varnishing the part of the floor not covered by the rug. (Allow 6 inches under rug, all around, to be varnished.)

3. An investor paid $6840 for a frame building. He spent $160 in repairs, and sold the house at an advance of 25% on the entire cost. How much did he gain? What was the selling price?

4. A newsboy bought papers for 1½¢ each and sold them for 2¢ each. What was his gain per cent and his total gain in selling 56 papers?

5. What is the commission at 2½% earned for selling 340 bu. wheat at $1.20 per bushel?

6. A baker formerly paid $4.85 for a bbl. of flour. If the flour has advanced in price to $7.82, what per cent more is he paying per bbl.?

7. A warship makes the following record in 4 hours: first hour, 19.5 mi.; second hour, 21.75 mi.; third hour, 22.2 mi.; fourth hour, 22.9 mi. What is the average hourly speed?

8. An agent charged 2% commission and $56.40 expenses for selling grain. He sent to his principal $1477.30. For what sum was the grain sold?

9. What is the difference between ½% of $8000 and 50% of $8000?

10. What will it cost to dig a cellar 60 ft. long, 30 ft. wide and 8 ft. deep, if the excavating costs 50¢ a cu. yd.?

11. A dealer in books bought 240 readers @ 42¢, and 320 geographies @ \$1.10. If he is allowed a discount of 8% and another of 2% for cash, what is the net amount of the bill?

12. A merchant gained 12½% by selling 48 yd. of silk for \$4.50 more than it cost him. What did he pay a yard for the silk?

13. Standard silver is composed of 37 parts of pure silver and 3 parts of copper. What per cent of the whole is each of these components?

14. A buyer is offered one discount of 50% or successive discounts of 30, 20, and 10%. Which is the better offer for him to accept, and how much does he save on his bill by choosing it? What would be the difference on a bill of goods listed at \$3500?

15. Insert names, dates, and items and find the balance on hand in this account: On hand, \$127.30; receipts, \$75, \$46.50, \$21.75; payments, \$50, \$26.30, \$14.90.

16. A man bought a farm of 196 acres for \$9800 and after spending \$980 for improvements sold the farm at \$66 an acre. What was his per cent of gain?

17. Mr. Brigham bought an automobile tire that was guaranteed for 3500 mi. At the end of 21 wk., the tire gave out, being 1050 mi. short of the guarantee. What was the average number of miles per week the tire was used? What was the per cent?

18. A dealer's inventory shows that he has 488 cases of tomatoes; if this is 22% more than he had at his last inventory, what did he have then?

19. In a certain year, the taxes on a piece of property assessed at \$7500 was \$1.85 per \$100. The next year, the tax rate was \$.70. What was the difference in the tax?

20. A man in the suburbs paid \$4275 for a house. If he sold it at an advance of 4½%, what did he gain?

III. HOW MONEY EARNS MONEY: INTEREST

Borrowing and Lending. Business men very often have occasion to borrow money in order to buy a new line of goods, to expand their business, or to erect new buildings. By furnishing good security, they obtain the money they require from banks and trust companies. The bank virtually " hires out " the money to the borrower, and charges a certain percentage for the use of it, somewhat as rent is charged for the use of a building for a certain period.

Money that is paid for the use of money is called **interest.** For example: if a man borrows $900 at a charge, or rental, of 5% of the $900 for one year, he is said to pay interest at 5%, or 5% interest.

The money which the banks and trust companies lend is taken from the sums placed in their charge as deposits. They *pay* interest to depositors and *receive* interest from borrowers who of course pay the banks a higher rate than the banks pay the depositors.

The sum for the use of which the interest is paid is called the **principal.** The **rate** is the percentage or number of hundredths which the interest is of the principal. 6% is the most common rate; that is, for the use of $1 for a year a man pays 6% of the $1; or 6¢. For the use of $1 for 3 years, a man pays 3 times 6% of $1, or 18¢.

The **time** is the period in years or parts thereof (months, days) that the loan runs and " earns " the interest. The principal plus the interest is the **amount.**

A man borrows $2400 for 2 years and 4 months to use in expanding his business. He agrees to pay 6% interest for the use of this money; that is, 6 cents a year for the use of each dollar.

$2400
.06
144.00 = interest for 1 yr.
$2\frac{1}{3}$
48
288
$336 = interest for 2 yr. 4 mo.
2400
$2736 = amount

In this example $2400 is the **principal.** The **rate** is 6%. The **time,** $2\frac{1}{3}$ years. The **amount** to be paid is $2736.

To compute the interest for any number of years:

Find the interest for 1 *year and multiply that result by the number of years, changing months to fractions of a year.*

ORAL EXERCISE

Find the interest for 1 *year on:*

1. $500 at 5%; at 7%
2. $300 at 4%; at 6%
3. $700 at 3%; at 5%
4. $900 at 6%; at 2%
5. $1100 at 7%; at 4%
6. $630 at 6%
7. $910 at 5%
8. $520 at 2%
9. $800 at 6%
10. $1600 at 4%
11. $1200 at 6%
12. $1300 at 4%
13. $1500 at 5%
14. $2100 at 6%
15. $2500 at 5%

WRITTEN EXERCISE

Find the interest on:

1. $640 for 2 yr. at 6%
2. $930 for 1 yr. at 4%
3. $2000 for 3 yr. 2 mo. at 3%
4. $128 for 2 yr. 6 mo. at 6%
5. $1428 for 2 yr. 2 mo. at 6%

6. $735 for 1 yr. 4 mo. at 5%
7. $840 for 1 yr. 5 mo. at 3%
8. $860 for 8 mo. at 6%
9. $184 for 1 yr. 1 mo. at 4%
10. $630 for 6 mo. at 3½%
11. $420 for 3 yr. 6 mo. at 6%
12. $540 for 2 yr. 6 mo. at 5½%
13. $1450 for 4 yr. 8 mo. at 4%
14. $720 for 1 yr. 2 mo. at 3½%
15. $1280 for 2 mo. at 6%
16. $410 for 2 yr. 3 mo. at 3%
17. $1440 for 3 mo. at 5%
18. $380 for 5 mo. at 6%
19. $660 for 6 mo. at 3½%
20. $728 for 1 yr. 10 mo. at 4%

Use of Cancellation.

Find the interest on $800 for 1 yr. 2 mo. at 6%:

Since 1 yr. 2 mo. is $\frac{14}{12}$ of a year, the whole operation can be written:

$$\overset{8}{\cancel{800}} \times \frac{\overset{}{\cancel{6}}}{\underset{}{\cancel{100}}} \times \frac{\overset{7}{\cancel{14}}}{\underset{2}{\cancel{12}}} = \$56.$$

WRITTEN EXERCISE

Find the interest on:

1. $1200 for 1 yr. 9 mo. at 4%
2. $882 for 1 yr. 4 mo. at 6%
3. $460 for 2 yr. 6 mo. at 3%
4. $882 for 10 mo. at 2½%
5. $840 for 1 yr. 2 mo. at 5%

6. \$1440 for 1 yr. 6 mo. at 3%
7. \$721.20 for 2 yr. 2 mo. at 6%
8. \$520 for 2 yr. 8 mo. at 6%
9. \$576 for 8 mo. at 6%
10. \$654 for 1 yr. 4 mo. at 5%
11. \$1200 for 1 yr. 6 mo. at $3\frac{1}{2}$%
12. \$320.40 for 2 yr. 4 mo. at 5%

Short Method in Interest: Six Per Cent Method for Days. Find the interest on \$1 for 1 day at 6%:

If 360 days be counted to the year, the result is:

$$\$1 \times \frac{1}{360} \times \frac{6}{100} = \$\frac{1}{6000}$$

The interest on \$1 for 1 day, therefore, is $\frac{1}{6000}$ of a dollar.

Find the interest on \$930 for 82 da. at 6%:

Since the interest on \$.930 will be 930 times the interest on \$1, and since the interest for 82 da. will be 82 times the interest for 1 da., we write:

$$\frac{\overset{31}{\cancel{930}} \times \overset{41}{\cancel{82}}}{\underset{200}{\underset{\cancel{600}}{\cancel{6000}}}} = 12.71$$

Note that we at once divide the principal by 1000, moving the decimal point three places to the left.

WRITTEN EXERCISE

Find the interest at 6% *on:*

1. \$390 for 90 days
2. \$1800 for 40 days
3. \$3720 for 100 days
4. \$825 for 30 days
5. \$42.40 for 120 days
6. \$900 for 60 days
7. \$1242 for 45 days
8. \$1320 for 80 days
9. \$940 for 60 days
10. \$1220 for 30 days
11. \$720 for 55 days
12. \$860 for 90 days

Find the interest on \$720 at 6%, from June 4 to Sept. 12:

The exact number of days is 100.

$$\frac{\$72\cancel{0}\times\cancel{100}}{\cancel{600}}=\$12$$

When the interest dates are given: first, determine the exact number of days between those dates; then, find the interest at 6%—remembering that the interest for \$1 for 1 da. at 6% is $\$\frac{1}{6000}$ or $\frac{1}{60}¢$.

ORAL EXERCISE

State quickly the interest at 6% on:

1. \$600 for 60 da.
2. \$750 for 30 da.
3. \$850 for 60 da.
4. \$925 for 30 da.
5. \$800 for 90 da.
6. \$540 for 60 da.
7. \$720 for 90 da.
8. \$820 for 60 da.
9. \$900 for 30 da.
10. \$960 for 60 da.

WRITTEN EXERCISE

Find the interest on the following at 6%:

1.	\$640	from Mar. 4	to July 10
2.	1200	from Aug. 12	to Nov. 12
3.	345.60	from Oct. 15	to Jan. 3
4.	846	from May 9	to Aug. 20
5.	920.40	from June 25	to Sept. 25
6.	1800	from Mar. 8	to July 6
7.	1440	from Sept. 2	to Oct. 24
8.	924.60	from Mar. 13	to May 13
9.	2400	from Oct. 28	to Jan. 5
10.	3600	from Jan. 25	to Apr. 25

To Find the Interest for Years, Months, and Days.

Find the interest on \$600 for 2 yr. 1 mo. 10 da. at 5%:

2 yr. 1 mo. 10 da. = 720 + 30 + 10 = 760 da.

This can be written: $\$\cancel{600} \times \frac{5}{\cancel{100}} \times \frac{\overset{38}{\cancel{760}}}{\underset{\cancel{6}}{\cancel{360}}\ 3} = \frac{\$190}{3} = \$63.33$

ORAL EXERCISE

What are the number of days between:

1. May 15 and Sept. 26
2. June 11 and Dec. 31
3. Aug. 18 and Nov. 13
4. Apr. 20 and June 25
5. Sept. 3 and Nov. 26

What is the interest on:

6. \$1 for 15 da.?
7. \$2 for 10 da.?
8. \$3 for 30 da.?
9. \$5 for 15 da.?
10. \$4 for 90 da.?
11. \$2 for 36 da.?
12. \$1 for 33 da.?
13. \$2 for 66 da.?
14. \$5 for 72 da.?
15. \$8 for 96 da.?

16. What is the interest on \$1 for 10 mo. 18 da.?

17. What is the interest on \$5 for 1 yr. 5 mo.?

18. What is the time between Jan. 1, 1916, and Mar. 1, 1916?

19. What is the time between Mar. 18, 1914, and Aug. 1, 1914?

20. State, without trying to solve, how you would proceed to find the interest on \$360 for 2 yr. 3 mo. 12 da.

WRITTEN EXERCISE

Find the interest on:

1.	$240	for	1 yr.	2 mo.	10 da.	at	4%
2.	$860	for	8 mo.	20 da.		at	6%
3.	$925	for	10 mo.	5 da.		at	5%
4.	$4200	for	1 yr.	2 mo.	15 da.	at	3%
5.	$1120	for	1 yr.	3 mo.	20 da.	at	5%
6.	$342.10	for	1 yr.	6 mo.	10 da.	at	6%
7.	$600	for	2 yr.	6 mo.		at	3½%
8.	$828.20	for	1 yr.	3 mo.	10 da.	at	4%
9.	$1260	for	2 yr.	3 mo.	15 da.	at	6%
10.	$1800	for	1 yr.	4 mo.	10 da.	at	5½%
11.	$564	for	2 yr.	8 mo.	20 da.	at	3%
12.	$460.50	for	1 yr.	6 mo.	15 da.	at	4%
13.	$723.25	for	2 yr.	2 mo.	3 da.	at	6%
14.	$1600	for	1 yr.	8 mo.	15 da.	at	4½%
15.	$865.50	for	1 yr.	5 mo.	5 da.	at	5%
16.	$1220.10	for	1 yr.	8 mo.	10 da.	at	6%
17.	$964.20	for	9 mo.	15 da.		at	3%
18.	$3000	for	2 yr.	1 mo.	5 da.	at	4½%
19.	$420.50	for	1 yr.	5 mo.	15 da.	at	5%
20.	$564.80	for	1 yr.	8 mo.	3 da.	at	4%
21.	$890	for	2 yr.	6 mo.	10 da.	at	3½%
22.	$340	for	2 yr.	3 mo.	5 da.	at	6%
23.	$2200	for	1 yr.	8 mo.	3 da.	at	3½%
24.	$600	for	8 mo.	20 da.		at	4¼%
25.	$725	for	2 yr.	6 mo.	15 da.	at	5%
26.	$969	for	2 yr.	7 mo.	10 da.	at	6%
27.	$2400	for	10 mo.	10 da.		at	5¼%
28.	$1200	for	1 yr.	1 mo.	20 da.	at	3%

29. On June 19, 1916, I borrowed \$960, agreeing to pay 5% interest. How much did I pay on Jan. 4, 1918 to cancel the debt?

yr.	mo.	da.		yr.	mo.	da.	
1918	1	4	=	1917	12	34	= second date
1916	6	19	=	1916	6	19	= first date
				1	6	15	= difference in time.

In subtracting dates, treat them precisely as in ordinary subtraction—borrow from the preceding group the value of one of that group. Therefore, in above, borrow 1 mo. (30 da.), making the day group 34; borrow 1 yr. (12 mo.), making the month group 12; the year group will be 1917; the difference is then quickly and surely obtained:

1 yr. 6 mo. 15 da. = 555 da.

30. A storekeeper borrowed \$720 from one bank on June 15 at 5%, and \$600 from another bank on Sept. 1 at 4½%. He repaid the sums on Nov. 1. How much did he pay?

31. On Jan. 18, 1915, a man borrowed \$242 at 5%. How much did he pay to the lender on Mar. 31, 1916 to cancel the debt?

32. What is the interest and amount on \$4500, borrowed Apr. 15, 1915 and paid on Jan. 2, 1917, with interest at 5%?

33. For the use of \$3300 from Mar. 10 to Apr. 24 at 6%, what interest should be charged?

34. What is the interest due on a loan of \$1250 from May 16, 1901 to July 12, 1901 at 6½%?

35. \$800 was borrowed at 6% on Jan. 2, 1916 and repaid on Feb. 29, 1916. What amount was then due?

36. On May 16, 1915, I borrowed \$720, agreeing to pay 5% interest. On Sept. 5, 1916, I repaid \$400 which included the interest to that date. How much did I still owe on that date?

37. A man borrowed \$2500 at 6% for 2 yr. 4 mo. 10 da. What is the amount he owed at the end of that term?

38. A business man borrowed \$620 at 5% for 1 yr. 8 mo. 5 da. How much would he have saved if he could have gotten this loan at $3\frac{1}{2}$%?

39. How much must I pay a bank for the use of \$456 for 1 yr. 3 mo. 20 da. at 6%?

40. On Aug. 10, 1913, a man borrowed \$560 at 6% and, on Dec. 4 of the same year he borrowed \$375 at 4%. He repaid these sums with interest on Mar. 20, 1914. How much interest had accrued?

41. What is the interest on \$960 at 5% from Oct. 7, 1916 to Aug. 10, 1918?

42. To how much more will the interest amount on \$2200 for 1 yr. 8 mo. 10 da. at 6% than at 4%?

43. What is the interest on \$2000 at 6% from Jan. 1, 1916 to Jan. 18, 1918?

44. Which will be the more profitable for the owner of a house and by how much: to rent the house for \$40 a month, the taxes and repairs for the year amounting to \$175, or to sell it for \$5000 and invest the money at $4\frac{1}{2}$% interest?

45. On Apr. 20, 1917, a man borrowed \$550, agreeing to pay interest at $4\frac{1}{2}$%. On Feb. 25, 1918, he repaid \$400 which included the interest to that date. How much did he still owe on that date?

46. A storekeeper bought goods worth \$4000 on Mar. 15, 1916. If he had paid cash, he would have received a discount of 3%. Instead, he paid the bill on July 15 with interest at 4%. How much did he lose by not paying cash?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	\$3.40+\$2.80	\$3.46−\$.75	\$6.80+\$2.20	\$2.40−\$1.50	\$1.55+\$2.60
2.	5.80+ 3.20	7.22− .25	7.20+ 1.40	4.50− 3.60	8.05+ 3.40
3.	6.30+ 1.70	8.14− .55	5.60+ 3.60	3.20− 1.30	3.45+ 5.80
4.	7.50+ 2.10	1.96−. 45	4.80+ 2.20	6.80− 4.90	4.15+ 2.40
5.	2.90+ 5.60	3.08− .35	3.10+ 5.80	7.30− 3.40	7.25+ 1.90

	Give the interest for 1 yr. on :		*Give commission on:*		
6.	\$320, 3%	\$111, 6%	\$500, 3%	\$600, $\frac{1}{2}$%	\$480, 12$\frac{1}{2}$%
7.	\$440, 4%	\$220, 5%	\$600, 4%	\$1000, $\frac{1}{5}$%	\$500, 20 %
8.	\$510, 6%	\$130, 4%	\$700, 5%	\$900, $\frac{1}{3}$%	\$720, 16$\frac{1}{3}$%
9.	\$350, 2%	\$250, 3%	\$800, 7%	\$800, $\frac{1}{8}$%	\$240, 8$\frac{1}{3}$%
10.	\$120, 4%	480, 2%	\$900, 6%	\$800, $\frac{1}{4}$%	\$320, 6$\frac{1}{4}$%

11.	$75 \div 5$	$\frac{3}{4}$ of 96	?)65 / 13	8×13	?)75 / 15
12.	6×15	7×16	$? \times 7 = 84$	$96 \div 4$	9×13
13.	$\frac{1}{6}$ of 78	$64 \div 16$	$\frac{1}{9}$ of 108	$\frac{1}{2}$ of 82	$84 \div 6$
14.	?)56 / 14	$\frac{1}{7}$ of 49	9×16	11)121 / ?	$\frac{1}{5} \times 80$
15.	$\frac{2}{3}$ of 72	?)83 / 11	$132 - 12$	$\frac{4}{5}$ of 85	$\frac{1}{2}$ of 78

Read:

16.	XII	CLX	$\overline{\text{C}}$D	IX	CCXIX
17.	XXIX	XL	LXIV	XLIX	$\overline{\text{M}}\overline{\text{C}}\overline{\text{D}}$XX
18.	XXX	XVII	M	D	MCCXL
19.	XLIV	CXIX	XLVII	MCIX	XXXIV
20.	LX	IV	CXIV	$\overline{\text{M}}$CDX	MCDIV

21.	$1\frac{1}{4}+\frac{3}{4}$	$\frac{3}{4} \times 20$	$\frac{3}{5} \div \frac{4}{5}$	$1\frac{1}{3}+\frac{1}{4}$	$\frac{1}{2}-\frac{1}{2}$
22.	$2\frac{1}{2}+\frac{1}{3}$	$\frac{5}{3} \times 30$	$\frac{7}{8} \div \frac{3}{5}$	$1\frac{1}{2}+\frac{1}{3}$	$\frac{7}{9}-\frac{2}{3}$
23.	$\frac{7}{12}+\frac{1}{4}$	$\frac{7}{8} \times 40$	$2\frac{1}{2} \div \frac{3}{4}$	$1\frac{1}{2}+\frac{2}{3}$	$1\frac{1}{4}-\frac{1}{2}$
24.	$\frac{2}{3}+\frac{1}{6}$	$\frac{2}{3} \times 60$	$\frac{7}{8} \div 1\frac{3}{4}$	$\frac{7}{12}+\frac{3}{4}$	$1\frac{1}{4}-\frac{3}{4}$
25.	$\frac{5}{12}+\frac{7}{12}$	$\frac{3}{7} \times 35$	$4\frac{1}{2} \div \frac{1}{2}$	$\frac{2}{3}+\frac{2}{3}$	$\frac{3}{4}-\frac{2}{3}$

GENERAL WRITTEN PROBLEMS

1. A man's salary was \$1400 the first year. He was given an 8% increase each year for 4 years. What was his salary the fifth year?

2. Find the number which, when increased $14\frac{2}{7}\%$, is 640; which, decreased by 30%, is 350.

3. A dealer made a profit of 22% by selling an automobile at a gain of \$836. What was the cost? What was the selling price?

4. An investor sold 300 shares of mining stock for \$2580, thereby losing 14%. What had he paid per share for this stock?

5. An agent receives \$1092.42 and an order to purchase oats at 42¢ a bu. If he deducts his commission of 2%, how many bu. can he buy?

6. A purchaser secured a discount of 3% on a rug, thereby saving \$4.20. What was the list price of the rug?

7. Mr. Jones bought a house for \$3500. He paid cash \$500, and promised to pay the balance in three equal instalments, with interest at 6%. He paid his first instalment in six months; the second in a year and six months; the third at end of third year. What did the house cost if the payments were made with money drawn from a savings bank which was paying 4% interest?

8. A man borrowed \$250 on May 9, at 5%, and \$125 on June 15, at 6%. Each loan was to run 60 da. When was each due, and how much was the total interest?

9. A furniture dealer bought 15 sets of furniture on Feb. 1, at \$65 a set. He promised to pay for them on April 1, with interest at 6%. What was the total bill with the interest?

10. A man borrowed \$350 on Jan. 17, at 5%. What was the interest due on it Feb. 27?

IV. SAVING AND INVESTING MONEY

Saving Money. It is very necessary for every boy and girl to begin as soon as possible to save money, even though it be only a small amount like a few cents a week. When the sum amounts to a dollar, it can be deposited in a savings bank where it will begin to earn interest. As they receive deposits as small as even a few cents, the school banks are very helpful in the matter of starting a bank account. There is little that makes more surely for a feeling of self-respect than a bank account. The fact that the amount of the deposit may be small is of little moment; it is the act of saving a regular amount, however small, every week, that counts.

Savings Banks. Trust companies and other forms of banking institutions have savings departments. These pay about 2% interest every six months on all sums of money left with them for that period. The savings banks are organized solely for the interests of the depositors and the organizers receive no pay for their services. Savings bank deposits are among the safest of investments because these banks are governed by strict laws, and are permitted to invest the earnings of depositors in only the most conservative ways.

When a person opens an account in a savings bank, he is given a small **pass book** in which are to be entered the amounts of all his deposits. Every six months, the interest earned is entered to his credit as if a deposit. Whenever the depositor wishes to draw out money, he takes the pass book to the bank, and the amount withdrawn is entered in it. But, he ought not withdraw his savings, except for extraordinary needs.

WRITTEN EXERCISE

1. A boy saves an average of 8¢ every week day and 10¢ every Sunday from his earnings on a paper route. At the end of a year, he sends his mother to the country for two weeks, at a cost of $24.20. How much money has he left.

2. A girl saved from her salary $2.20 a week for one year and deposited the sum in a savings bank. How much interest will this sum earn for her in a year at 4%?

3. A boy is saving up to go on a camping trip. If his expenses will be $26.50 and he can set aside 85¢ a week, how long will it take him to save the money?

4. A working girl saves 15¢ every week day. To what will this amount in a year?

5. A man bought for his family a summer bungalow costing $1845. He paid $800 cash and agreed to pay $55 a mo. on the balance. How long will it take him to make the full payment?

6. An office boy saved 25¢ a day for 310 days a year. How much did he save in $2\frac{1}{2}$ years, not counting the interest?

7. A girl decides to buy a suit priced $22.50. If her salary of $16 a week is paid at the end of every week, how many weeks must she work to buy that suit, if she saves 15% of her salary?

8. A young man earning $12 a week, finds he can save 22% of his salary. How much will he be able to deposit in a savings bank at the end of two months?

9. From his earnings in selling a weekly magazine, a boy was able to save 48¢ a week. He continued this for 2 yr. 4 mo. until he entered high school. How much did he save in all?

10. A man's income is $1850 a year. How much does he save if he puts aside 12% of it?

11. A house owner decides to install in his house electric lighting. He finds that this will cost him $110.25. If he sets aside $12.25 a week from his salary, how many weeks must he save to make up the amount?

12. To save the 10¢ carfare each way a boy walks to high school 190 da. in the year for four years. What per cent of his first year's college expenses of $200 can he save by that expedient?

13. A school boy saves 15¢ a week, his sister saves 80¢ a week and an older brother saves $1.25 a week. If they do this for 52 wk. a yr. to how much will their savings amount in a year and a half?

14. The mother of a little girl saves for her three cents a day until she is 12½ yr. old. The money is then deposited in a savings bank. How much was the deposit?

15. A boy working during vacation and on Saturdays, found that he saved $124 a year. At the end of the next year he has increased his savings 22% at which time he deposited his savings for the two years in a bank at 5%. How much interest do they earn every year?

16. Mr. Treddel was offered a set of furniture for $250 at 7% discount for cash, or for $50 down and $10 a month for 1 yr. 10 mo. What per cent did he save by paying cash if he drew the money from a savings bank which paid 4% interest on his deposit?

The Postal Savings System. The government of the United States accepts deposits from the public and guarantees to repay them with interest upon demand.

When people live far from a savings bank, the postal savings system is very convenient. The rate of interest, only

2% a yr., is lower than in most savings banks, but depositors can always get their money when they wish it, and it is absolutely safe.

Opening Accounts. Any person 10 years old or over may open a postal savings account by depositing one or more dollars in any post office. In case the post office does not run a postal savings department, it will accept the deposits and forward them to the nearest authorized office. Nobody is allowed to carry, at one time, more than one account, either in the same office or at different offices.

A person may deposit any number of dollars, at any time, until the total of deposits amounts to $1000, exclusive of accumulated interest. After a postal savings account has been opened, deposits may be made either in person, by a representative, by money order, or by registered mail if the money-order service is not available. Postal savings deposits are acknowledged by postal savings certificates which are made out in the name of the depositor and serve as receipts. These certificates are not negotiable or transferable. If certificates are lost, stolen, or destroyed, new certificates may be obtained. A depositor may at any time withdraw all or any part of his postal savings deposits, upon demand, from the post office where the deposits were made. Withdrawals may be made in person, through a representative, or by mail.

Interest on Deposits. Postal savings certificates bear interest at the rate of 2% a year. Interest begins on the first day of the month following the deposit and becomes due and payable at the expiration of each full year from the day the interest begins and continues as long as the principal remains on deposit. No interest will be paid for a period less than a year.

Amounts less than \$1 may be saved by purchasing **postal savings cards** and **postal savings stamps** at 10 cents each. A savings card with nine savings stamps affixed will be accepted as a deposit of \$1 either in opening a postal savings account or in adding to an existing account.

A depositor may exchange the whole or a part of his deposits for United States **postal savings bonds**, bearing $2\frac{1}{2}\%$ interest, issued in denominations of \$20, \$100, and \$500. When bonds are issued in exchange for postal savings deposits, the balance to the credit of the depositor is reduced accordingly, and he may make further deposits until his account again reaches \$1000.

WRITTEN EXERCISE

1. What is the interest for 1 yr. on \$15 deposited in the Postal Savings Bank Feb. 4, 1917. On what date does this interest become due?

2. A man deposits in the Postal Savings Bank \$48 on March 15, 1915, and \$160 on Apr. 24, 1915. What interest will these sums earn in a year and when will the interest be due?

3. A boy deposited in the Postal Savings Bank \$3 on June 2, 1916; \$4 on June 18; \$3 on June 28. What was the interest due on July 1, 1917?

4. How much interest will \$420 earn in 2 yr. in a Postal Savings Bank? How much more interest would it earn in a regular savings bank at $3\frac{1}{2}\%$?

5. A man deposits in a Postal Savings Bank \$81 on Apr. 20, 1915. On what date can he claim the interest, \$1.62?

6. How much interest will \$75, deposited in a Postal Savings Bank on May 29, 1916, earn in 2 yr.? At what date will the interest be due?

Commercial Banks. Commercial banks differ in many ways from savings banks. The commercial bank is organized for the convenience of merchants and others engaged in business: Their convenience is served by granting credit to business men who need to borrow money; by providing a safe place of deposit for money; by arranging a convenient method of paying bills by checks that can be sent through the mails, without danger of a money loss. Generally, the commercial bank pays no interest on deposits, but it also makes no charges for the handling of the customers' checks, etc. The bank makes its profit by lending out at interest the great sums composed of balances of the depositors. Commercial banks are called **banks of deposits.**

To Deposit Money. To open an account, Robert L. Long goes to the manager of the bank, introduces himself, and gives references as to his character and his business status. He agrees to keep his balance above a certain sum; he leaves his signature, written exactly as he means to sign all his checks. He then hands in whatever money or checks he wishes to deposit, and the receiving teller gives him a pass book with the amount entered in it. He also is given some deposit slips.

DEPOSITED BY
Robert E. Long
Sept. 6, 1918
IN
MUTUAL BANK OF ROSEVILLE

		$	¢
Coin		*16*	*50*
Bills		*120*	
Check on Bank			
" *Traders* "		*32*	*40*
" *12th National* "		*3*	*95*
" *Lincoln Tr. Co.*		*15*	
		187	*85*

In making deposits after this, Mr. Long uses one of these slips, properly filled out. This slip is handed to the

receiving teller with money and checks, and the pass book. Deposits are added to his balance in the bank.

WRITTEN EXERCISE

Get deposit slips from banks near your school, to be used in making out slips for the first six examples:

1. A. W. Brown deposited $28.10 in silver, $381 in bills, check on Chase National Bank, $77.50, check on Yorkville Bank, $24.48.

2. Harrison Bros. Co., deposited $114.65 in coin, $348 in bills, check on Greenpoint National Bank, $1110, check on Merchants' Exchange Bank, $27.95, check on Fidelity Trust Co., $106.63.

3. Dimock & Fink deposited $186.11 in coin, $401 in bills, check on Broadway Central Bank, $78.18, check on Fourth National Bank, $718.59.

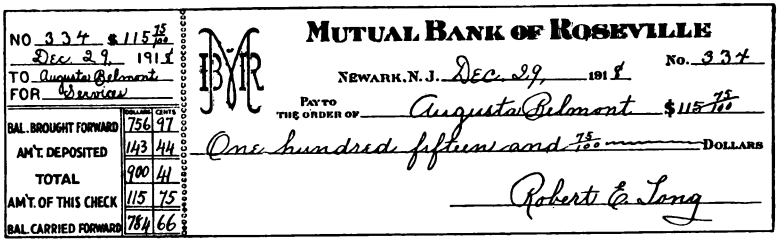
4. The Empire Company deposited $84.93 in coin, $659 in bills, check on Hanover National Bank, $8.16, check on Brooklyn Trust Co., $37.05.

5. Breck & Hopkins deposited $32.04 in coin, $112 in bills, check on Southern National Bank, $240.60, check on Merchants' National Bank, $1085.

6. The general organization of your school has $314.63 to deposit in a neighborhood bank. There are checks for $4.75 and $36.93; the balance is in bills and coin.

7. A depositor leaves $47 in the Postal Savings Bank from Jan. 2, 1914 until Nov. 3, 1918. How much will he be able to draw out including interest?

8. A man holds three 100-dollar and two 500-dollar savings bonds. What is the amount of interest received for one year?


NO 334 $115 75/100
Dec 29 1911
TO Augusta Belmont
FOR Dresses

	DOLLARS	CENTS
BAL. BROUGHT FORWARD	756	97
AM'T. DEPOSITED	143	44
TOTAL	900	41
AM'T. OF THIS CHECK	115	75
BAL. CARRIED FORWARD	784	66

MUTUAL BANK OF ROSEVILLE

No. 334

NEWARK, N. J. Dec. 29, 1911

PAY TO THE ORDER OF Augusta Belmont $115 75/100

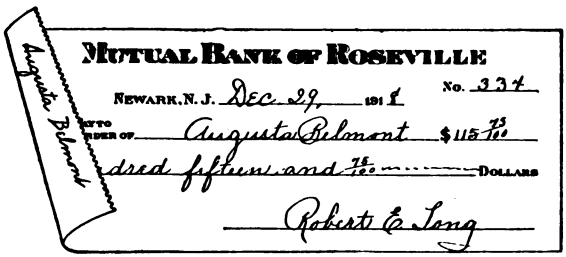
One hundred fifteen and 75/100 DOLLARS

Robert E. Long

How Checks are Used. When he opens his account, Mr. Long receives a check book containing blank checks to be used when he wishes to pay bills or draw out money.

In this check, Mr. Long is the **drawer** and Augusta Belmont the **payee**, because the check is made payable to her.

After the check has been made out and the record of it entered upon the stub that is to remain in the book as a permanent record, the check itself is detached and given or sent to the payee. The amount of check drawn must be subtracted from the balance in the bank.


Augusta Belmont

MUTUAL BANK OF ROSEVILLE

No. 334

NEWARK, N. J. Dec. 29, 1911

PAY TO THE ORDER OF Augusta Belmont $115 75/100

dred fifteen and 75/100 DOLLARS

Robert E. Long

Indorsing a Check. Augusta Belmont, having received Mr. Long's check, desires to deposit it in the Chemical National Bank. Before she can deposit the check, she must write her name across the back of it—that is, **indorse** it.

She can now deposit it; or, if she prefers, she may receive the cash for it, if the cashier knows her; else, she must have herself identified. The check itself is charged back to the bank upon which it was drawn, which, in turn, charges it to Mr. Long's account, cancels it and returns it eventually to Mr. Long.

If Mr. Long wishes to draw out money for his own use, he may make a check payable to " Self," in which case no one else can cash it unless " indorsed over " by him; or he may make it out to " Cash " or " Bearer," and then any one can cash it.

Banks usually request depositors to leave their pass books with the bookkeeper at least once in three months, so that accounts can be balanced and canceled checks returned to the depositors. If he has made no errors in keeping his stub records, Mr. Long should find that the balance in his check book agrees with that reported by the bank. Sometimes, some of the checks will not have been presented for payment; in such cases, the bank balance will appear just that much larger than his stub balance.

In the larger banks of the country, it is the usage to make out to all depositors a monthly **Statement of Account**, and to return with this statement all the canceled checks. In these banks, the pass book is used only as a receipt for deposits made.

It is becoming more and more the custom, especially in the larger cities, to consider the canceled checks as receipts, and very many business men want no other, and, except when especially requested, they themselves give no other. Under these circumstances, it becomes vitally necessary that all canceled checks be carefully kept and filed.

WRITTEN EXERCISE

1. A check book shows deposits of \$111.18, \$72.53, \$108.40, \$27.96, \$200, \$36.67; and checks drawn for \$35, \$9.17, \$146.73, \$35. Find the bank balance.

2. Graham Furniture Company deposits in Oct. \$149.73, \$556.10, \$900, \$187.14, \$763.42, \$510.08; checks drawn are \$150, \$73.75, \$150, \$6.23, \$149.50, \$650. If the balance on Sept. 30 was \$1214.10, find the balance on Oct. 31.

3. A man's check book shows a balance of \$30.18. If he deposits \$72.40, \$315, \$129.16, \$84.05, \$103.98; and draws 3 checks for \$25 each and one for \$175.50, what is his present balance?

4. A clerk earns a monthly salary of \$270 which he deposits. He draws checks to pay rent at \$52 a mo. and additional checks for \$58.73, \$92, \$39.93, \$54.68, \$75, \$212.06, \$139.40, \$63.75. What is his balance at the end of the year, if he had a balance from last year of \$720.65?

5. Mr. Geo. N. Coombes paid Ferris & Gelder \$83.40 for carpenter work. The bill was paid on Jan. 15 by check on the Tenth National Bank. Write out the check and stub.

6. The treasurer of your athletic association makes out a check today to A. G. Spalding & Bros. for \$92.10 for athletic goods. Make out such a check and stub.

7. On Dec. 28, Harry A. Fisher agrees to buy a new laundry machine for \$950. He is to pay 40% in cash, 20% in 6 mo. at 4% interest, and the balance in 1 yr. at 5% interest. Draw checks on the Commercial Trust Company for the three payments.

8. The school general organization made deposits in one year of \$46.10, \$24.14, \$8.19, \$13.06, \$84.65, \$12.08, \$3.14; and drew checks for \$92.10, \$25, \$10, \$7.73. If there was a balance of \$111.15 at the beginning of the year, what is the present balance?

ORAL DRILL EXERCISE

	A		*B*		*C*		*D*	*E*
Find the selling price:								
	Cost:	Gain:	Cost:	Loss:	Cost:	Loss:		
1.	\$2.60	100%	\$400	25%	\$12	$37\frac{1}{2}\%$	$\frac{3}{5}\times\frac{5}{9}$	$\frac{2}{3}$ of $\frac{3}{4}$
2.	\$80	$12\frac{1}{2}\%$	\$38	50%	\$15	$33\frac{1}{3}\%$	$\frac{3}{4}\times\frac{3}{8}$	$\frac{1}{2}$ of $\frac{5}{8}$
3.	\$20	40%	\$20	30%	\$16	75%	$\frac{4}{5}\times\frac{8}{9}$	$\frac{3}{8}$ of $\frac{5}{9}$
4.	\$36	$66\frac{2}{3}\%$	\$42	$16\frac{2}{3}\%$	\$300	10%	$\frac{5}{6}\times\frac{2}{3}$	$\frac{3}{4}$ of $\frac{3}{8}$
5.	\$100	25%	\$20	80%	\$200	80%	$\frac{7}{8}\times\frac{5}{6}$	$\frac{5}{6}$ of $\frac{2}{3}$

Find the volumes:

6.	$4'\times6'\times\frac{1}{2}'$	$2'\times\frac{3}{4}'\times8'$	$300''\times20''\times4''$	$21\div\frac{7}{10}$	$4\times\frac{2}{3}$
7.	$8''\times7''\times2''$	$16''\times3''\times\frac{1}{2}''$	$\frac{7}{8}'\times\frac{1}{2}'\times4'$	$24\div\frac{8}{11}$	$2\times\frac{3}{4}$
8.	$3'\times\frac{2}{3}'\times\frac{3}{4}'$	$4''\times12''\times\frac{3}{4}''$	$16''\times10''\times10''$	$10\div\frac{2}{7}$	$3\times\frac{5}{8}$
9.	$6'\times12'\times\frac{1}{2}'$	$36''\times4''\times\frac{3}{12}''$	$\frac{5}{8}'\times12'\times8'$	$18\div\frac{9}{10}$	$4\times\frac{7}{8}$
10.	$18'\times10'\times2'$	1 yd. $\times\frac{1}{2}$ yd. $\times$ 8 yd.	$2'\frac{1}{6}\times'\times30'$	$16\div\frac{2}{9}$	$8\times\frac{3}{4}$

Find the areas:

11.	8 ft. $\times$ 16 ft.	$3\frac{1}{2}'\times2'$	$137+24$	$115-54$	$20\div\frac{4}{5}$
12.	40 ft. $\times\frac{3}{4}$ ft.	$13''\times\frac{1}{2}'$	$224+36$	$186-47$	$30\div\frac{6}{7}$
13.	21 rd. $\times$ 7 rd.	$46''\times5''$	$319+53$	$224-32$	$40\div\frac{2}{15}$
14.	6 in. $\times\frac{2}{3}$ in.	$18'\times100'$	$248+14$	$219-43$	$16\div\frac{4}{13}$
15.	$4\frac{1}{2}$ in. $\times$ 4 in.	$300'\times4'$	$356+39$	$333-51$	$14\div\frac{7}{9}$
16.	? ft. in 78 in.	$224+28$	$119-48$	$\frac{1}{2}+\frac{1}{3}$	$\frac{1}{2}-\frac{1}{12}$
17.	? da. in 12 wk.	$294+37$	$408-57$	$\frac{1}{12}+\frac{5}{12}$	$\frac{7}{8}-\frac{1}{2}$
18.	? ft. in 3 rd.	$337+46$	$225-63$	$\frac{5}{12}+\frac{5}{12}$	$\frac{3}{4}-\frac{1}{2}$
19.	? qt. in 7 gal.	$441+54$	$371-72$	$1\frac{3}{4}+\frac{3}{4}$	$\frac{7}{9}-\frac{1}{3}$
20.	? qt. in 12 pk.	$506+63$	$316-41$	$2\frac{2}{3}+\frac{2}{3}$	$\frac{7}{9}-\frac{2}{3}$
21.	? pt. in 3 pk.	$249+34$	$108-67$	$\frac{1}{12}+\frac{1}{4}$	$1\frac{1}{4}-\frac{3}{4}$
22.	? oz. in 6 lb.	$156+43$	$219-29$	$\frac{2}{5}+\frac{3}{10}$	$1\frac{3}{4}-\frac{1}{2}$
23.	? ft. in $\frac{1}{2}$ mi.	$317+58$	$564-54$	$\frac{1}{8}+\frac{3}{4}$	$1\frac{1}{3}-\frac{2}{3}$
24.	? pk. in 9 bu.	$451+50$	$210-76$	$1\frac{5}{6}+\frac{5}{6}$	$1\frac{2}{3}-\frac{1}{9}$
25.	? pt. in 8 gal.	$763+17$	$313-33$	$\frac{1}{9}+\frac{2}{3}$	$1\frac{1}{2}-\frac{3}{4}$

GENERAL WRITTEN PROBLEMS

1. If a family uses $1\frac{1}{2}$ lb. meat a day, how much will be saved in a month of 30 days by buying steak that costs 28¢ a lb. rather than steak that costs 35¢ a lb.?

2. An apartment house owner received from his agent \$16,121.40 yearly rent. If the agent had deducted his commission of 3%, what was the monthly rent collected?

3. A carpenter took a job of repairing a barn for \$285. He hired 8 men at \$2.50 per day and 3 men at \$1.75 per day; all the men worked 9 days. What was the carpenter's profit?

4. If I lend a friend \$480 for 1 yr. 3 mo. 10 da. at 6%, how much should I receive for the use of my money?

5. What is the difference in cost between a set of furniture marked \$173.50 with a discount of 20% and one marked \$125.75 without discount?

6. An agent's commission for selling rubber goods was \$140 at $1\frac{1}{2}$%. What was the amount of his sales?

7. Three pieces of city property are assessed at \$4200, \$5700, and \$2400. What is the amount of the bill if the tax rate is \$7.20 per \$1000?

8. A farmer has 240 fowls for which he is offered by one buyer $12\frac{1}{2}$¢ a lb. and by another \$4.75 per dozen fowls. If the average weight of the fowls is $3\frac{1}{4}$ lb., which is the better offer and by how much?

9. An errand boy earns \$4 a week. He can have a 25% increase or he can secure an office position at \$25 a month. Which position would pay the more annually and how much?

10. What per cent of profit is made in manufacturing electric fans at \$9 and selling them at \$10.80?

11. Paul Smith had the use of \$375 for 1 yr. 4 mo. 15 da. at 5%. Write out the check for the amount he repaid.

12. Find the balance on hand in the following cash account: Receipts: \$28.27, \$53.19, \$109.38, \$15.65, \$1.30; Payments: \$6.42, \$38.39, \$4.37, \$7.36, \$.50.

13. The list price of a player-piano was \$655 but discounts of 15% and 5% were allowed. What was the net price?

14. A shirt waist requires 3 yd. of material at 15¢ a yd., one spool of thread at 5¢ a spool, and ½ doz. buttons at 20¢ a doz. If the charge for labor is 20¢ an hour for 8 hours, what is the gain if the waist is sold for \$3?

15. After a fire, a manufacturing company found that its liabilities (debts) were \$10,000. At the end of 6 mo., it was able to pay \$4840. What per cent of the indebtedness was still to be paid?

16. Money deposited in a certain savings bank on July 1 or Oct. 1, draws interest at 4% a year, if left on deposit till the following Jan. 1. A boy deposited \$25 on July 1, 1915 and \$35 on Oct. 1, 1915; find the amount of his balance after the interest was added Jan. 1, 1916.

17. Make a receipted bill for these goods sold by you to H. C. Steel: 60 grapefruits at 65¢ per doz.; 3 lb. tea at 82½¢ per lb.; 4 doz. eggs at 50¢ per doz.; 8 lb. sugar at 9¢ per lb.; 5 lb. bacon at 45¢ per lb.

18. The standing in arithmetic of a seventh grade pupil was as follows: Sept., 89%; Oct., 85%; Nov., 91%; Dec., 85%; Jan., 96%; Feb., 87%; Mar., 89%; Apr., 97%; May, 96%; June, 88%. Find his monthly average for the school year.

19. A dealer bought 240 bbl. of apples at \$1.75 a bbl. He lost 40 bbl. through frost. At what price per bbl. must be sell the remainder to gain 25% on his investment?

V. MEASUREMENT

Foreign Money. In a year before the Great World War, over $2,000,000,000 worth of products from the United States were sold to 19 foreign countries. As each country has its own system of money, it is necessary to know the U. S. equivalents of the moneys of the principal countries of the world, especially of the European and South American countries.

ORAL EXERCISE

State the approximate equivalents of the following:

1. £61	6. 300 fr.	11. £60	16. £11 2s.
2. £14 3s.	7. 240 fr.	12. £300	17. £150
3. 88 M.	8. 80 R.	13. 500 fr.	18. 20 P. (Mex.)
4. 120 M.	9. 120 R.	14. 640 M.	19. 880 Yen
5. 16 fr.	10. 1600 R.	15. £20 10s.	20. 24 milreis

Use approximate equivalents in the following:

21. How much will an Austrian immigrant receive for 1000 crowns when he exchanges his money in New York?

22. If I send $55.50 to a friend in Liverpool, how much will he receive for it in British money?

23. A soldier was given eight 10-franc gold pieces. How much was this worth in our money?

24. A motor cycle costs 700 M. in Berlin. About how much is this in our money?

25 How much will a money exchange office allow for 900 rubles?

26. An Italian immigrant brings with him 400 lire. How much will he receive in our money?

Table of Equivalents.

COUNTRY	STANDARD	ABBREVIATION	PRONUNCIATION	EXACT VALUE	APPROX. VALUE
Argentina	Peso	P.	pā′so	$.965	$1.00
Austria	Crown	Cr.	kroun	.203	.25
Belgium	Franc	fr.	frănk	.193	.20
Brazil	Milreis	M.	mĭl′rās	.546	.50
China	Tael	T.	tāl { Shanghai / Canton	.651 / .711	.70
Denmark	Crown	Cr.		.268	.25
France	Franc	fr.	frănk	.193	.20
Germany	Mark	M.	märk	.238	.25
Great Britain	Pound	£	pound	4.8665	5.00
	Shilling	s.	shĭl′ĭng	.243	.25
	There are 12 pence (d.) in the s.; 20s. in the £				
Holland	Florin	Fl.	flŏr′in	.402	.40
	Gulden	G.	go͝ol′dĕn		
Italy	Lira	L.	le͞e′rä	.193	.20
	pl. Lire		le͞e′rā		
Japan	Yen	Y.	yĕn	.498	.50
Mexico	Peso	P.	pā′sō	.498	.50
Norway	Crown	Cr.		.268	.25
Russia	Ruble	R.	ro͞o′b'l	.515	.50
Spain	Peseta	P.	pĕ-sā′tä	.193	.20
Sweden	Crown	Cr.		.268	.25
Switzerland	Franc	fr.	frănk	.193	.20
Venezuela	Bolivar	B.	bō-le͞e′vär	.193	.20

See the TABLES at the end of the book for the money-equivalents of other countries.

Remember that the equivalents, given above as *exact*, are not always the *market value* at a given time.

The value of foreign moneys depends upon very many conditions; this valuation changes, sometimes from day to day, especially during times of stress.

It will be an interesting study for you to go to your nearest bank, now and then, and find out the exact value at those times. (The bank will call that value the **Exchange**.)

27. In Manchester, England, a Rugby ball costs 12s., a worsted shirt 18s., a pair of gymnasium shoes 10s. Tell what the prices would be in dollars and cents.

28. How many shillings has a Glasgow newsboy if he has 60d. in his pocket?

29. A Mexican changed 800 pesos into dollars and cents. About how much American money did he receive?

30. A pair of shoes in Brazil cost 18 milreis. What was this in American money?

31. A typewriter sells in Argentina for 95 pesos. This is about how much in our money?

32. A Japanese boy received a present of 4 yen from his uncle. How much would this be in our money?

33. How do the approximate values of the franc, lira, bolivar, and crown compare?

34. If you were in England and paid 6d. for a pencil, how many would you get for an American quarter?

35. Think of the following pieces of money as according to the U. S. values, and state what the value is of a 3-mark piece; of a 10-franc piece; of 100 lire; of 50 rubles.

WRITTEN EXERCISE

Use exact equivalents in these problems:

1. An importer ordered a quantity of Japanese screens. The bill amounted to 4220 yen. What was the cost in American money?

2. A lady bought a dress in London for £8 9s. 11d. What was the cost in our money?

3. A Russian sable coat was appraised in a U. S. custom house at $480. At this rate what was its value in Russian money?

4. What is the amount in our money of a bill for a shipment of wine amounting to 4640 fr.?

5. An ink manufacturer ordered 840 lb. of color dyes at 7 M. a lb. What is the cost in American money?

6. Olive oil shipped from Italy is billed at 2320 lire. What is its value in U. S. money?

7. James McCreery & Co. bought in London furs valued at £1300. What is the value in U. S. money?

8. Which set of books would be the cheaper: an English set costing £1 10s. 6d., or a French edition costing 26 fr.? What is the difference in our money?

Find the exact equivalents in U. S. money:

9. £112	13. 315 lire	17. 348 fr.	21. 408 R.
10. 19s.	14. 2800 lire	18. 4260 fr.	22. 1870 R.
11. £12 6s.	15. 4475 lire	19. 475 M.	23. 5200 fr.
12. 910 M.	16. £66 4s.	20. 8100 M.	24. 3000 R.

25. A department store in Buenos Aires ordered 600 pesos' worth of toilet soap, curtains worth 870 pesos, and sewing machines to the value of 1900 pesos. What is the amount of the order in U. S. money?

26. An American manufacturer received an order from a firm in Rio for 35 automobiles to cost 3800 milreis each. What was the amount of the order in our money?

27. A Red "D" Line steamer brought from Venezuela coffee worth 11,000 bolivars, cocoa beans worth 4600 bolivars, and rubber valued at 1800 bolivars. Find the amount of this shipment in our money.

28. Every year the United States buys 4,250,000 pesos' worth of chicle for use in making chewing gum. What is the value of it in our money?

METRIC SYSTEM

When American business houses receive orders from European merchants for manufactured goods, the measurements and dimensions of the articles are not written in inches, feet, pounds, tons, or gallons, but in units of the **metric system.** Accordingly a knowledge of this system is important, indeed necessary. Moreover, we constantly encounter references to it in newspapers and magazines, and some of the government departments make use of it. Nearly all the civilized nations of the world except the United States and Great Britain use the metric system. Its use is obligatory in Porto Rico and in the Philippines.

The **metric system** is founded on a unit of length called the **meter** and from this are derived all the other measures of length, of areas, of volume, of weight, and of capacity.

Metric Equivalents.

The **meter** (m.) is the unit of length and is equal to 39.37 inches (United States standard), or about 1 yd. 3 in.

The **centimeter** (cm.) is one hundredth of a meter, or about $\frac{2}{5}$ in.

The **kilometer** (Km.) is 1000 meters and is about $\frac{5}{8}$ mile.

The **liter** (l.) is the unit of capacity and is about the same as a quart.

The **kilogram** (Kg.) is 1000 grams and is approximately $2\frac{1}{5}$ lb.

As the metric system is a decimal system like our dollars and cents, each unit bears a decimal relation to every other unit in the same scale. Units may be changed to those of higher or lower denominations in the same scale by simply moving the decimal point.

ORAL EXERCISE

1. The edge of a desk is 30 cm. long. About how much is this in inches?

2. A clerk sold 12 m. of cloth. How many yd. did he sell?

3. A boy in France writes that he was within 8 Km. of a battle trench. How many miles was that?

4. A Swiss milk can holds 20 liters of milk. About how many gallons does it contain?

5. About how many pounds does a boy weigh whose weight is recorded as 40 Kg.?

6. The average width of an American newspaper is 55 cm. How many inches is that?

7. The distance covered in an auto race was 300 Km. For how many miles did the cars race?

8. A tank that contains 900 liters, holds approximately how many quarts of water?

9. A block of ice weighs 75 Kg. How much is this in pounds?

10. At a distance of 90 m. from a bursting shell a soldier was killed by the concussion. How many feet away was he standing?

The Use of Prefixes. Four of the seven prefixes used in the metric system denote that *multiples of the unit* are to be taken:

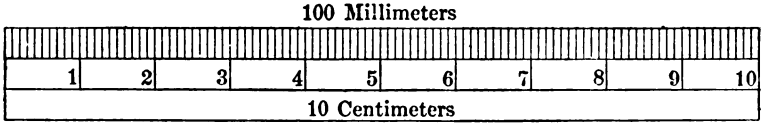
deka-	means	10	1 dekameter	= 10 meters
hekto-	means	100	1 hektoliter	= 100 liters
kilo-	means	1000	1 kilogram	= 1000 grams
myria-	means	10,000	1 myriameter	= 10,000 meters

Three of the prefixes are used as *divisors of the unit:*

deci-	means	.1	1 decimeter	= .1 of a meter
centi-	means	.01	1 centimeter	= .01 of a meter
milli-	means	.001	1 milligram	= .001 of a gram

Metric Table of Length

10 millimeters (mm.)	= 1 **centimeter** (cm.)	= .01 of a meter
10 centimeters	= 1 decimeter (dm.)	= .1 of a meter
10 decimeters	= 1 **meter** (m.)	
10 meters	= 1 dekameter (Dm.)	
10 dekamaters	= 1 hektometer (Hm.)	= 100 meters
10 hektometers	= 1 **kilometer** (Km.)	= 1000 meters
10 kilometers	= 1 myriameter (Mm.)	= 10,000 meters



1/10 Meter, or 1 Decimeter

The **millimeter** is .03937 in., which is nearly .04, or $\frac{1}{25}$, of an inch; accordingly, the **centimeter** is nearly .4, or $\frac{2}{5}$, of an inch. The **kilometer** approximates 3280.8 feet, or $\frac{5}{8}$ of a mile; it is used in measuring distances and journeys. The meter is used in business, to measure wire, rope, cloth, etc.

ORAL EXERCISE

1. A cent is 2 cm. in width. About what part of an inch is that?

2. A wire is 8.15 in. long. How many cm. long is it?

3. How many meters of ribbon would be needed to make 20 badges each 20 cm. long?

4. First estimate and then verify with the meter stick the width and length of the schoolroom, the blackboard, the windows, the door, the teacher's desk, your desk, a blank book.

5. The Eiffel Tower in Paris is 300 m. high. How high is this in feet?

6. The United States Post Office accepts packages not over 30 cm. in length, 20 cm. in width, and 10 cm. in thickness. Express these dimensions in inches.

Tell the approximate equivalents:

7. 9 m.	11. 20 m.	15. 10.5 m.	19. 8.2 m.
8. 8 dm.	12. 5 Dm.	16. 25 dm.	20. 40 cm.
9. 3 cm.	13. 10 Hm.	17. 32 Km.	21. 11 Dm.
10. 5 mm.	14. 20 Km.	18. 1 cm.	22. 10 mm.

WRITTEN EXERCISE

1. The distance from Paris to Rome is 136 Km. How many mi. is this distance?

2. How many rounds are there in a ladder 12 m. long, whose rounds are 40 cm. apart?

3. If the current of a river flows 1980 m. in an hour, how many meters does it flow in a minute? How far is that in our measure?

4. The distance around a race track is 2.48 Km. How many meters will a horse travel that runs around it four times? About how long is the course in our measures?

5. Find the diameter in inches of the mouth of a French 75-mm. gun. What is the caliber in inches of a German 42-cm. cannon?

6. A merchant bought 300 m. of silk at $2.50 per m., and sold it at $2.25 a yd. Did he gain or lose and how much?

Write the equivalents:

7. 82 m.	15. 6.5 Km.	23. 47 m.
8. 4.5 m.	16. 15 m.	24. 2.5 dm.
9. 12 Km.	17. 88 Km.	25. 8.4 dm.
10. 3.4 Km.	18. 228 cm.	26. 90.2 cm.
11. 14.5 cm.	19. 38.1 dm.	27. 800 mm.
12. .8 cm.	20. 96 Km.	28. .5 Km.
13. .2 m.	21. 37.6 m.	29. 9.5 Hm.
14. 8 mm.	22. 426.5 Km.	30. 360 Hm.

31. A train travels at a speed of 72.45 Km. an hour. How many miles an hour is this?

32. The distance between two Russian cities is 136 Km. How many mi. apart are they?

33. A street is 20 m. wide. How many ft. and in. in its width?

34. Which throws a larger shell: an American 16-in. gun, or a German 42-cm. gun?

35. If a city park is 3.8 mi. long, how long is it, expressed in terms of the metric system?

Metric Table of Capacity.

10 milliliters (ml.)	= 1 centiliter (cl.)	= .01 of a liter
10 centiliters	= 1 deciliter (dl.)	= .1 of a liter
10 deciliters	= 1 **liter** (l.)	
10 liters	= 1 dekaliter (Dl.)	
10 dekaliters	= 1 **hektoliter** (Hl.).	= 100 liters

The **liter** is about 1 quart. It is used to measure liquids, berries, fruits, etc. The **hektoliter** equals approximately 26.42 gal. or nearly 2.84 bu. It is used in measuring liquids in large quantities and also grains and vegetables.

A liter of water weighs 1 Kg.

ORAL EXERCISE

1. A vat contains 420 l. of wine. About how many gals. is this?

2. About how many gal. in 20 Hl. of wine?

3. How many liters in 3 Dl.; 2 Hl.; 4 pt.; 100 dl.; 500 ml.; 40 gal.?

4. 28 bu. of wheat is about how many Hl.?

5. A glass holds 1 dl. How many times can it be filled from a bottle containing 2 l.?

WRITTEN EXERCISE

1. A merchant bought 18.5 Hl. of gasoline at $22 a Hl., and sold it at 26¢ per l. What was his profit?

2. What will 48 Hl. of wheat cost at $18 per 200 l.?

3. A grocer bought peas at $3.00 a Hl. and sold them at 4¢ a l. What per cent did he gain?

4. Change 7 Hl. to equivalent units in U. S. measures.

5. Express 13 gal. in metric equivalents.

6. How many bottles each containing .5 l. can be filled from a barrel holding 12 Dl.?

7. A man paid 800 francs for 100 l. of wine. About what price did he pay for it per gallon?

Metric Table of Weights.

10 milligrams (mg.)	= 1 centigram (cg.)	= .01 of a g.
10 centigrams	= 1 decigram (dg.)	= .1 of a g.
10 decigrams	= 1 **gram** (g.)	
10 grams	= 1 dekagram (Dg.)	
10 dekagrams	= 1 hektogram (Hg.)	= 100 g.
10 hektograms	= 1 **kilogram** (Kg.)	= 1000 g.
10 kilograms	= 1 myriagram (Mg.)	= 10,000 g.
10 myriagrams	= 1 quintal (Q.)	= 100,000 g.
10 quintals	= 1 **metric ton** (T.)	= 1,000,000 g.

The **gram** is the *weight* of a cu. centimeter of distilled water, and it approximates 15½ grains. This measure is used by druggists and jewelers, and also on postal scales.

A five-cent piece weighs about 5 grams.

The **kilogram** more commonly called kilo, is used in the weighing of merchandise, and it equals about 2.2 pounds.

The **metric ton** is the *weight* of a cu. meter of distilled water, and it is equal to about 2204 pounds. It is used in weighing the more bulky merchandise, such as coal, hay, etc.

ORAL EXERCISE

1. How many dg. in the weight of 40 nickles?
2. How many pounds in 3 T. (metric)?
3. How many pounds in 20 kilos of flour?
4. How many g. in 3 Dg.? 4 Kg.? 100 dg.? 800 cg.? 8 Hg.?
5. Express 5 T. (metric) as kilos; 4 Q. as kilos.
6. How many more pounds of rice in 10 metric tons than in 10 U. S. tons?

WRITTEN EXERCISE

1. 1 l. of water weighs 1 Kg. Find the weight in kilo of 12 l. of olive oil, which is .915 times as heavy as water.
2. If a steamer burns 820 kilos of coal in a day, how much will the coal for a voyage of 8 da. cost at $9 a metric ton?
3. An importer received a shipment of rubber goods weighing 1240 Kg. How many lb. in this shipment?
4. How many grams are there in 244.5 Kg.? How many pounds?
5. A silver dollar weighs 412.5 grains. About how many g. does it weigh?
6. Give the approximate equivalents in English measures of 440 kilos; 300 g.; 3.2 T. (metric).
7. How many kilos in 4760 lb. of sugar?
8. How many kilos of flour are there in a bbl. weighing 196 lb.?
9. A train leaves a station at 8.35 A.M., and reaches the next station, 26 Km. away, at 9.00 A.M. What is the speed per hour of that train?
10. A certain street in Paris is 20 meters wide. How many feet and inches is it wide?

VI. BUSINESS FORMS AND PRACTICE

Writing Orders for Goods. In writing orders for goods, it is always important for us to date each order, and to mention the catalogue number of each article if ordered from a catalogue, and to specify quantity and quality, and such details as color and size. Sometimes, it is necessary to designate the date and mode of shipment as well as the place to which the goods are to be sent, and to refer to the mode of payment.

JOSEPH MALONEY
FURNITURE
GREAT BARRINGTON, MASS.
March 5, 1918.

John H. McHugh & Co.,
115 West 42 St.,
New York.

Gentlemen:

Please send me the following by Adams Ex.:

12 No. 67 Willow Rockers
6 No. 11 Oak Writing Desks
4 No. 173 Sofa Beds

Very truly yours,
JOSEPH MALONEY
per _____ *C. T. A.*

The numbers written in the order refer to the McHugh Company catalogue in which numbered illustrations of the furniture are printed.

WRITTEN EXERCISE

Write letters ordering the following goods; insert the addresses:

1. To Park and Tilford: 3 Thermos food jars No. 602; ½ doz. rubber combs No. 181; 1 doz. French tooth br shes No. 57L.

2. To A. G. Spalding & Bros.: ½ doz. pr. golf stockings No. G.C.; 1 doz. Red Dot golf balls; 1 copy "Golf for Girls."

3. To John Wanamaker: 1 Meadow Brook bench No. 84, 2 Bancroft tables No. 17B, 2 Barnard College swings No. 28A, 2 Waverley book racks No. 5.

Bills. When the furniture has been crated and forwarded by the McHugh Company, the bookkeeper mails a bill to Joseph Maloney for the goods and *debits* his account for the amount of the purchase.

JOHN H. McHUGH COMPANY
CRAFTSMAN FURNITURE
WHOLESALE 115 WEST 42 STREET RETAIL
NEW YORK

Sept. 9, 1917.

Sold to Joseph Maloney,
Great Barrington, Mass.

TERMS: Net, thirty days
2% cash, ten days

Sept.	7	12 Willow Rockers #67	5.35	64	20		
		6 Oak Writing Desks #11	15.	90			
		4 Sofa Beds #173	16.50	66			
				220	20		
			Less 2%	4	40		
						215	80

RECEIVED PAYMENT
SEPT. 15, 1917
JOHN H. McHUGH CO.
per E.C.W.

Note that since Mr. Maloney paid this bill within ten days, he was allowed a cash discount of 2%.

Mr. Maloney paid the bill by sending his check for it. Make out the check.

The McHugh Co. bookkeeper receipted the bill, returned it to Mr. Maloney, and *credited* the latter's account with the amount of the check *and* the discount.

Was it necessary for Mr. Maloney to send the bill with the check?

WRITTEN EXERCISE

Make out bills for the following purchases; insert the names, addresses, and dates:

1. Bought of James McCreery & Co., N. Y.: 18¾ yd. storm serge @ $1.12; 3 pr. grey Mocha gloves @ $2.45; 1 toilet table @ $18.50. Discount 10%.

2. Bought of Thorp & Martin, Boston: 4 M. letterheads @ $2.25; 1 M. billheads @ $2.60; 3 qt. writing fluid @ $.75; 3 M. envelopes @ $1.75. Discount 2%.

3. Make out for yourself the bill for the goods in Exercise 1, page 82. Allow a discount of 3%.

4. Bought of C. A. Allen & Co.: 24 No. 27*c* woven wire mattresses @ $12.25; 10 No. 71*a* child's cribs @ $7.85; 24 No. 16 wool mattresses @ $8.25; 24 No. 495 white iron bedsteads @ $11.75. Discount 30%.

5. Make out to classmates the bills for the goods in Exercises 2 and 3, page 82. Take off cash discounts of 3%.

6. Bought of Hull, Grippen & Co.: 6 ice cream freezers @ $3.62; 12 doz. mortise locks @ $6.40; ½ doz. planes No. 4 @ $30.50; 10 sets knives and forks No. 11*c* @ $1.85. Discount 29%.

7. Bought of W. F. Pratt Co.: 200 yd. Brussels carpet @ $1.35; 150 yd. ingrain carpet @ $.75; 145 yd. oil cloth @ $.28; 6 rugs 16′×20′ @ $45. Discount 15%.

Statements. To buy goods to be paid for at some time later is to buy the goods **on credit.** At the time the goods are delivered or shipped, the seller, if a business concern, gives the purchaser, or sends him a list of articles, with the prices, called **an invoice.** This invoice enables the customer to verify or check the items of the purchase when actually received, and also to check the **bill,** which usually is sent to him later.

Statement

New York, March 1, 1918

B. Altman & Co.

Fifth Avenue - Madison Avenue
Thirty-fourth and Thirty-fifth Streets

Mrs. Henry B. Harlan
36 West 78th Street
New York

Terms

		To Balance	12	70		
Feb.	3	To Mdse.	8	55		
	8	" "	52			
	11	" "	23	26		
	24	" "	14		110	51
			50			
	15	By Cash	30		80	
	20	" "				
					30	51

This statement shows that $12.70 of the preceding month's account was not paid, so is carried forward. The February dates show when goods were delivered.

For each purchase, a bill was rendered at the time the goods were sent.

In this case, B. Altman & Co. is the **creditor**, because the firm has given credit to Mrs. Henry B. Harlan, who is the **debtor.**

On or about the first of every month, the dealer sends to each customer a written record showing the amount of the purchases for the previous month, the payments that have been made, and the balance outstanding. This record, or reminder, is a **statement** of the account—many firms prefer the name **monthly statement.**

WRITTEN EXERCISE

Make out statements of these accounts, using the names of the business firms given on p. 83 and the names of classmates as the purchasers; insert dates:

1. To balance, $8.02; to mdse., $18.75; $9.63; $24.45; $114; $96.25. By cash, $35; $100; $40; $70.
2. To balance, $111.70; to mdse., $48.76; $54.63; $102.25; $137.46; $201.84; $200. By cash, $75; $150; $80; $168.
3. To balance, $167.96; to mdse., $48.47; $165.10; $237.46; $301.50; $197.63. By cash, $285; $54.50; $235; $75; $100.
4. To balance, $1.37; to mdse., $4.86; $5.37; $15.25; $37.46; $50; $1.25. By cash, $25; $25; $35.
5. To balance, $38.47; to mdse., $46.96; $120; $456.33; $102.48, $7.47. By cash, $250; $250; $175.

Receipts. When a bill is paid in money, the bill is receipted by the clerk who receives the money, or is taken by him to the cashier, who receipts it. If a check is given in payment, the canceled check as returned by the bank is more often made to serve as the receipt, though admittedly not so convenient for the customer as a record, or evidence, as a receipted bill. (*See* page 82.) In case of a payment for value received for which there has been no bill, a special receipt should be required. In such a case, if the payment is made by a check, it is wise to have a regular bill made out, and duly receipted.

Philadelphia, Nov. 6, 1917

Received of *Gerald Van Casteel*

Ninety-five $\frac{60}{100}$ ***Dollars***

on account.

$\$95\frac{60}{100}$ *Donald F. Bergh.*

In this receipt, note that the amount acknowledged is not the whole of the debt. A payment in part is called a **payment on account.**

When Mr. Van Casteel makes his final payment, the receipt should read "**in full to date.**"

WRITTEN EXERCISE

1. Make out a lawyer's receipt for two hundred fifty dollars in part payment of his bill.

2. Harold Walsh delivers a repaired bicycle at a house in your neighborhood. Write out the receipt he receives.

3. Write out a receipt given to your parent for last month's rent.

4. Write out a receipt given by you to a driver from a large sporting goods house who delivers at the school 6 basket-ball suits, 6 pr. 8-yr. slippers, and 2 basket balls.

5. Mrs. Henry Branson paid to Dr. Eugene A. Phelps $45 on June 1, 1917, on account for professional services rendered. Write the doctor's receipt for the money.

6. Archibald Scott paid the firm of Seabury, Hunt & Collins, $585 on May 18, 1916, for services rendered. Write the receipt.

Keeping a Cash Account. A cash account gives a record of money received and paid out. Here is the account that Joseph Malcney keeps with **Cash** for one week.

CASH

1917		Dr.			1917		Cr.		
Sept.	2	Balance on hand	149	12	Sept.	2	Rent	70	
	4	Colonial Inn	26	62		4	Salaries	62	
	5	H. L. Crofut	82	60		6	Slauson Garage	23	
		Coburn Co.	10			9	John H. McHugh	186	40
	7	Slauson Garage	97	25			Balance	79	99
	8	Berkshire Inn	55	80					
			421	39				421	39
Sept.	9	Balance	79	99					

Dr. means the debtor, and is placed on the debit side of the account. On Sept. 1, the cash account is debited with the amount on hand, $149.12.

Cr. means the creditor, and is placed on the credit side of the account.

Note that in this account the balance is found by subtracting the total of the money paid out from the total of the amounts received and the original balance on hand.

The account is debited at the end of the week with **$79.99,** the balance on hand.

Charge, *or* **debit, Cash** *with all moneys received.*

Credit Cash *with all moneys paid out.*

The **balance** *is found by subtracting the lesser totals of one side from the greater totals of the other.*

WRITTEN EXERCISE

Make out cash accounts, for a week or a month, using the following amounts, but inserting dates and items. Carry each balance forward:

1. Balance, \$3.40. Receipts: \$.75; \$1.20; \$.68; \$.20; \$2.40. Payments: \$2; \$.25; \$.85; \$1.39; \$.10; \$.10.

2. Balance, \$48.92. Receipts: \$37.46; \$25.45; \$100; \$3.88; \$44.26; \$17.09. Payments: \$55.46; \$3.46; \$.79; \$1.83; \$15.05; \$84.79.

3. Balance, \$.84. Receipts: \$.20; \$1.38; \$.48; \$.25; \$.25; \$.80; \$1.10; \$.05. Payments: \$.25; \$.50; \$3.38; \$.74; \$18; \$.06.

4. Write out the cash account of the treasurer of your school organization for one month as you think the figures would be.

5. Write out your own cash account for the past month as nearly as you can recall it.

6. Imagine that you are acting as treasurer of the school baseball team. Write out the account you would keep with Cash.

7. Balance, \$729.50. Receipts: \$71.89; \$125.80; \$.25; \$75.25; \$8.06. Payments: \$7.89; \$18.70; \$345.75; \$10.45. Make out this cash account in the name of some shopkeeper that you know.

8. Balance, \$12.85. Receipts: \$2.85; \$5.75; \$2.64; \$45.25; \$1.25. Payments: \$3.99; \$1.35; \$3.92; \$16.24. Make out this account as though it were a week's account of a tailor in your neighborhood.

9. Make out a cash account for your mother's last week's household expenses, as you think that they may have been.

Personal Accounts. Here is a record of the personal account of the John H. McHugh Co. with Joseph Maloney, of Great Barrington, Mass.

JOSEPH MALONEY

1917		Dr.				1917		Cr.		
Sept.	1	To balance due		118	03	Sept.	3	By Cash	100	
	9	12 Rockers @ 67	5.35	64	20		15	Cash	215	80
		6 Desks @ 11	15.	90				Discount	4	40
		4 Sofa Beds @ 173	16.50	66			30	Balance	51	51
		2 Dining Chairs @	4.24	8	48					
		5 Parlor Lamps	5.	25						
				371	71				371	71
Oct.	1	To Balance due		51	51					

Business houses are obliged to keep personal accounts with each of their customers, that the exact condition of indebtedness may be found out instantly.

WRITTEN EXERCISE

Make out these personal accounts inserting items and dates:

1. Mrs. Sidney Reeves runs an account with a butcher. On Feb. 2 she owed $11.05. Her purchases were $3.60; $4.12; $1.28; $2.36; $5.47; $1.12. She paid $10 and $15 during the week. Find how her account appears on Feb. 9.

2. Copy the account of Joseph Maloney and continue it for the month of October.

3. Make out the account of a sporting goods house with your school athletic association for a term. Balance due $23.25. Purchases: $48.40; $2.05; $13.20; $6.85; $26. Payments: $48.40; $25.

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	12 lb. @ $37\frac{1}{2}¢$	197 − 38	16 lb. @ 25¢	126 + 42	\$1.10 × 20
2.	24 lb. @ $62\frac{1}{2}¢$	148 − 79	28 lb. @ 50¢	139 + 83	2.30 × 30
3.	16 lb. @ $12\frac{1}{2}¢$	163 − 74	12 lb. @ 75¢	176 + 38	1.20 × 40
4.	30 lb. @ $33\frac{1}{3}¢$	159 − 65	48 lb. @ 25¢	143 + 47	.33 × 30
5.	18 lb. @ $83\frac{1}{3}¢$	184 − 91	42 lb. @ 50¢	154 + 56	24 × 20
6.	1% of \$8.40	343 + 52	$\frac{1}{4}$% of \$1200	243 − 54	96 ÷ 12
7.	$\frac{1}{2}$% of \$4.00	247 + 63	9% of 200	286 − 96	95 ÷ 19
8.	4% of 1100	296 + 71	12% of 300	314 − 35	91 ÷ 13
9.	$\frac{1}{8}$% of 2400	319 + 84	$\frac{1}{2}$% of 800	324 − 48	80 ÷ 16
10.	6% of 3000	184 + 12	$\frac{1}{3}$% of 600	416 − 27	105 ÷ 15

	Find the interest on \$100 *for:*			*State results:*	
11.	1 yr. at 6%	$1\frac{1}{2}$ yr. at 2%	2 mo. at 6%	.78 × 100	$3\frac{1}{8} + 1\frac{3}{16}$
12.	6 mo. at 4%	$2\frac{1}{2}$ yr. at 4%	3 yr. at 5%	.96 × 100	$2\frac{2}{7} + 3\frac{1}{14}$
13.	2 yr. at 5%	$3\frac{1}{2}$ yr. at 1%	4 mo. at 3%	1.05 × 100	$4\frac{4}{9} + 7\frac{2}{3}$
14.	4 mo. at 3%	1 yr. at $3\frac{1}{2}$%	6 mo. at 5%	2.14 × 100	$5\frac{3}{11} + 9\frac{3}{11}$
15.	3 mo. at 4%	2 yr. at $2\frac{1}{2}$%	5 mo. at 6%	3.40 × 100	$7\frac{5}{8} + 1\frac{1}{2}$

State the approximate equivalents of:

16.	£7	300 M.	70 fr.	140 R.	£150
17.	25 M.	500 R.	25 M.	£21	1000 M.
18.	£10	2000 fr.	80 R.	11s.	£220
19.	100 R.	£25	8s.	80 M.	300 fr.
20.	6s.	15s.	500 fr.	£7	1000 R.

Find values:

21.	48 yd. @ 25¢	\$2.46 × 10	1.88 + .41	5.90 − 10	8. − 100
22.	24 yd. @ $37\frac{1}{2}¢$	.78 × 10	2.02 + 8.02	6.80 − 10	5. − 100
23.	40 yd. @ 75¢	1.12 × 10	.342 + .9	1.07 − 10	2.4 − 100
24.	64 yd. @ $62\frac{1}{2}¢$	5.69 × 10	.034 + .22	4.16 − 10	3.5 − 100
25.	27 yd. @ $33\frac{1}{3}¢$	23.17 × 10	4.75 + .25	5.56 − 10	11. − 100
26.	26 yd. @ 50¢	32.56 × 10	2.61 + 6.4	3.63 − 10	16. − 100
27.	27 yd. @ $66\frac{2}{3}¢$	71.38 × 10	.345 + 3.7	4.27 − 10	4.3 − 100

GENERAL WRITTEN PROBLEMS

1. A business man borrowed \$520 on March 3 at 6%. He paid the principal and interest on July 31. How much did he pay?

2. A field of 18 acres produces 26 bu. of wheat per acre. Each bu. of wheat makes 54 lb. of flour. If each barrel of flour weighing 196 lb. is worth \$5, what is the value of the crop?

3. A department store buyer ordered goods listed at \$3472. She was allowed discounts at $12\frac{1}{2}\%$ and 5%. What was the net cost of the goods?

4. Of 946 children attending an elementary school, 649 have to cross an automobile parkway to reach the building. What per cent of all the children have to cross the parkway?

5. Property worth \$9720 is assessed at $\frac{5}{8}$ of its value. If the rate is \$1.29 per \$100, what is the tax bill?

6. A storekeeper has a bank balance of \$793.06. He deposits \$246.53; \$196.50; \$238.47; \$543.72; \$200.10; \$313.38, He draws checks for \$200; \$336.75; \$200; \$458.16; \$354.11; \$20.05; \$750. He also has to draw a check for interest on the last amount at 4% for 90 da. What is his bank balance now?

7. Mr. Harris bought an apartment house for \$18,600 and later sold it through an agent for 92% of what he paid for it. If the agent charged $2\frac{1}{2}\%$ commission, how much did Mr. Harris receive for the house? What was his loss on his investment?

8. A boy's club bought a playerpiano for \$350. If they paid \$75 down and \$6.25 every week, how many weeks did it take them to complete the payments?

9. Write in Roman notation 95, 142, 563, 1776, 1918.

10. An automobile which sold in the United States for $1875, is sold in Scotland for £469. Find the exact difference in dollars and cents between the two prices.

11. Find the cost per acre to plow land, if one man with three horses plows 2 acres in 9 hours at the rate of 20¢ an hour for the man's time and 15¢ an hour for the time of each horse.

12. An automobile salesman received a salary of $185 a month and 4% commission on all his sales. The first six months the sales amounted to $44,275 and the second six months to $54,350. What was his income for the year?

13. If a man leaves $1260 in a bank for 1 yr. 3 mo. 24 da. and the money draws interest at 5%, how much money will he have to his credit at the end of this time?

14. By selling an ice cream freezer at $6.60 a dealer makes a profit of 20%. What per cent profit will he make if he raises the price to $7.15?

15. A man opened a plumbing supply store, investing $8250 in the stock of goods. The business failed and his debts amounted to $5280. To pay these he was forced to sell his stock at 74% of the cost. What per cent of his investment had he left?

16. The Russian War Office placed an order in New Haven for 625 machines at 220 rubles each. What was the exact amount of this order in dollars and cents?

17. Mrs. James T. Long bought of G. W. Sullivan, the florist: 2 boxes of pansy plants at 30¢; 2 doz. tomato plants at 20¢ a doz.; 4 rambler roses at 20¢; 1 doz. geraniums at 50¢. Make out the bill and her check in payment.

18. Henry Soule sold George Richardson a 12-lb. turkey at 38 cents per lb. Mr. Soule paid cash, but asked for a receipt. Make it out.

VII. SIMPLE EQUATIONS: OPTIONAL WORK

The Representation of Numbers by Letters. It is often necessary to find out what an unknown number is, when two or more are known. It is far easier to think, to talk, and to work with a *letter* than to use the cumbersome expression *unknown number.*

X is used most commonly to represent one unknown number.

(*a*) $8+?=17$

This may be written: $8+x=17$

As the sum (17) and one addend (8) are known, the unknown addend (x) is found by subtracting.

Therefore, $x=17-8$, or 9

(*b*) $?-7=27$

This may be written: $x-7=27$

As the remainder (27) and the subtrahend (7) are known, the unknown minuend (x) is found by adding.

Therefore, $x=27+7$, or 34

ORAL EXERCISE

Find the missing number (x) *in the following:*

1. $5+?=9$
2. $22-?=10$
3. $x-17=11$
4. $x+13=25$
5. $3+9=x+4$
6. $x-3=9-3$

7. What number increased by 4 equals 9?
8. What number less 3 equals 15?
9. If I had 38¢ more, I should have \$1. What have I now?
10. I bought a pair of skates and received \$2.40 in change from a \$5 bill. What did I pay for the skates?

(*c*) $11 \times ? = 66$

This may be written: $11 \times x = 66$

As the multiplicand (11) and the product (66) are known, the unknown multiplier (x) is found by dividing.

Therefore, $x = 66 \div 11$, or 6

It is not necessary to express the sign of multiplication between a number and x. It is understood. Therefore, the general way of expressing the above is: $11x = 66$.

(*d*) $18 \div ? = 3$

This may be written: $18 \div x = 3$

As the dividend (18) and the quotient (3) are known, the unknown divisor (x) is found by dividing.

Therefore, $x = 18 \div 3$, or 6

(*e*) $? \div 6 = 3$

This may be written: $x \div 6 = 3$

As the two known numbers here are the divisor and the quotient, the dividend is found by multiplying.

Therefore, $x = 6 \times 3$, or 18

ORAL EXERCISE

Find the missing number (x) in the following:

1. $4 \times ? = 32$
2. $x \div 6 = 4$
3. $16 \div ? = 4$
4. $x \times 7 = 49$
5. $3x = 4 \times 6$
6. $x \div 2 = 36 \div 3$

7. If 8 lb. of sugar cost x dollars, what was the cost of 1 lb.?

8. If the price of one pound of candy is x cents, what is shown by $2x$; $\frac{1}{2}x$; $3\frac{1}{2}x$?

9. If 15 knives cost x dollars, what was the price of each if I received in change from a ten-dollar bill: 1 $2 bill; 1 $1 bill; 2 half dollars; 2 quarters; 3 dimes; 4 nickles?

10. If a tennis racket costs x dollars, what does $3x$ mean?

WRITTEN EXERCISE

Solve the following by using x for the unknown number:

1. A number is taken from $19. If the remainder is $8.32, what is the number?

2. 72 taken from a number leaves 19. What is the number?

3. When 24 is added to a number, the sum is 113. What is the number?

4. John had 9 marbles more than Thomas. They had together 33 marbles. How many did they each have?

5. A horse was sold for $100 and this was $20 more than the cost. What was the cost?

6. Mary paid $1.20 for an arithmetic and a speller. If she paid twice as much for the arithmetic as she did for the speller, what did she pay for each?

7. A number is 3 times another. The difference between them is 24. What are the numbers?

8. There were 48 persons employed in a store. If the number of women was three times the number of men, how many were there of each?

The Equation. In the expressions $3\times8=6\times4$, or $x\times8(8x)=24$, you will notice that two numbers or combinations of numbers are equal. 3×8 are 24; so are 6×4. You can compare them, and when you do, you have made what is called an **equation**. In writing an equation, separate the members of equal value by the " equal sign."

To Solve Equations. Notice carefully how the value of x is found in the following:

(*a*) $18+x=20$

$18+x=20$
$18 \quad =18$
$x= 2$

Look at the equation carefully and you will see that, if you subtract 18 from both sides of the equation, you get at once the same result that you got in your oral work, when you *subtracted* one *addend* from the *sum* to get the *other addend.*

(*b*) $x-17=11$

$x-17=11$
$17=17$
$x \quad =28$

Look at this equation carefully and you will see that, if you add 17 to both sides of the equation, you eliminate the extra number on one side. It may puzzle you for a moment to get *nothing* after having *added* 17 to the -17. Think of it this way: If you are short 17 cents and your father gives you 17 cents, you really add the $+17$ to the -17 cents, and wipe out your indebtedness.

(*c*) $5x=220$

$\frac{\cancel{5}}{\cancel{5}}x=\frac{\overset{44}{\cancel{220}}}{\cancel{5}}$
$x=44$

Divide both sides of the equation by 5, to eliminate the third number.
Always cancel when you can.

(*d*) $\frac{x}{6}=12$

$\frac{x}{\cancel{6}}\times\cancel{6}=12\times6$
$x=72$

Multiply both sides of the equation by 6, to eliminate the fraction.

1. *The same number may be added to or subtracted from, both sides or members of an equation without affecting the value.*

2. *Both sides or members of an equation may be multiplied by, or divided by, the same number without affecting the value.*

WRITTEN EXERCISE

Find the value of x in the following equations:

1. $9 - x = 7$
2. $8 \times 3 = 6x$
3. $8 - \frac{1}{2} = 2x$
4. $x - 11 = 24$
5. $14x = 6 \times 7$
6. $15x = 12 \times 5$
7. $\frac{x}{3} = 27 - 9$
8. $12 = \frac{x}{2}$
9. $36 \div x = 18$
10. $11 + x = 29$
11. $22 - x = 10$
12. $28 + x = 41$

Solve the equations and analyze:

13. $\frac{x}{2} = 30$
14. $\frac{x}{2} = 6$
15. $\frac{x}{5} = 7$
16. $250 = \frac{x}{5}$

Find the value of x in the following:

17. $\frac{3}{5}$ of $x = 60$

Method: $\frac{3}{5}$ of $x = 60 : \frac{3x}{5} = 60$

$3x = 60 \times 5$, or 300

$x = 100$

17. $22 = \frac{11x}{4}$
18. $30 = \frac{6x}{8}$
19. $12x = 240$
20. $270 = \frac{5x}{6}$
21. $\frac{5x}{16} = 10$
22. $\frac{10x}{9} = 80$
23. $\frac{7x}{18} = 14$
24. $\frac{2x}{3} = 40$
25. $\frac{2x}{11} = 200$
26. $\frac{3x}{4} = 144$
27. $\frac{3x}{8} = 720$
28. $\frac{5x}{8} = 150$

The Use of the Equation in Problems. By using x to represent the unknown quantity, many problems can be easily worked by writing them in the form of equations.

Two teams played 36 games; the first team played 3 times as many games as the second. How many did each play?

Method: Let $x =$ the number played by 2d team.
Then $3x =$ the number played by 1st team.

$$x + 3x = 36$$
$$4x = 36$$
$$x = 9 \text{ games played by 2d team.}$$
$$3x = 27 \text{ games played by 1st team.}$$

WRITTEN PROBLEMS

1. Harry is x years old and John is 4 years older. If the sum of their ages is 26 years, how old is each boy?

2. A house and lot are worth \$3500. If the house is worth 6 times as much as the lot, what is the value of each?

3. The part of a pier under water is $\frac{2}{3}$ as high as the part out of water. If the pier is 45 feet high, what is the height of each part?

4. If $\frac{7}{8}$ of a number is 35, what is the number?

(Let $x =$ the number.)

5. If $\frac{6}{7}$ of a number is 48, what is the number?

6. $\frac{3}{4}$ of the distance between two towns is 30 mi. What is the distance between the towns?

7. $\frac{4}{5}$ of a number is 28. What is the number?

8. What number increased by $\frac{2}{5}$ of itself will equal 84?

(Let $x =$ the number.)

9. A very large class of boys was made smaller by transferring into another class $\frac{3}{8}$ of its pupils. It now contains 45 boys. How many were in the class at first?

(Let x = the number at first.)

10. A grocer sold olive oil for $\frac{1}{3}$ more than it cost him. If he received \$1.20 a quart for it, what was the cost?

The Use of the Equation in Percentage. Very many problems in percentage can be worked more easily and quickly by turning them into equations.

ORAL EXERCISE

1. A bicycle costing x dollars was sold at a gain of 20%. What does $\frac{6x}{5}$ represent?

2. A barrel of flour that cost x dollars was sold at a loss of 8%. What does $.08x$ represent? What does $x-.08x$ represent?

3. A hat costing x dollars was sold at a loss of 25%. What does $\frac{3x}{4}$ represent?

4. A man borrows \$350 for x yr. at 6%. What does $\$350 \times .06x$ represent?

5. A fountain pen was sold for x dollars at a gain of 10%. What does $\frac{1x}{10}$ represent? What does $x+\frac{1x}{10}$ represent?

In the oral problems above, use market prices for the goods, and compare the ordinary method of working by percentage with the method that you have just used.

WRITTEN EXERCISE

1. \$63.90 is 15% of what number?

Method: Let x = the number
Then $.15x = \$63.90$

$x = .15)\overline{\$63.90}$

\$426

2. A man receives \$520 a month in rent from an apartment house. This is 13% of the value of the house. What is its value?

3. During a season, a baseball club won 72 games and lost 12 games. What per cent of the games played were won?

4. A lot was sold for \$1260, which was an advance of 12% on his cost. What did it cost?

(Let x = the cost.)

5. An automobile, sold at a gain of 10%, brought \$2200. What was its original cost?

6. A dealer sold a damaged carpet for \$42.50 at a loss of 15%. What did the carpet cost him?

7. The price of a boy's coat this year is \$27.25, which is 9% greater than the price last year. How much did it cost last year?

8. After deducting a discount of 3% from a bill, a business man sends a check for \$1202.80. What was the amount of the bill?

(Let x = amount of the bill.)

9. A horse that cost \$145.50 was sold for \$194. What was the gain per cent?

10. A farm was sold for \$4140, which was at a gain of 15%. Find what the farm cost.

11. The amount of a certain principal at 4% interest for 1 year was \$416. What was the principal?

12. An agent earned \$625 by selling phonographs on a commission of 20%. Find the value of the phonographs he sold?

13. A farmer has 372 sheep, which is 20% more than he had last year. How many did he have then?

14. After spending 65% of his salary, a clerk had left \$385. What was his salary?

15. A tailor sold a suit for \$31.20, which was 20% less than the price he had asked for it. What was the price he asked?

16. A man's salary was increased 15%, and now it is \$1050. What was his former salary?

17. An automobile was sold for \$840, the seller thereby gaining 25% of what he paid for it. How much did he pay for it?

18. A man has on hand 15% of the amount necessary to build his house. If he has on hand \$825, how much will his house cost him?

19. A farm that had cost \$15,600 is improved and then sold. If the cost of that farm was $33\frac{1}{3}\%$ less than the sum for which it sold, what was the selling-price?

20. A boy is given his choice between the purchase of a motor boat and a motor cycle. If the motor cycle costs \$175, and that is 65% of the cost of the boat, what is the price of the boat?

21. A dealer was obliged to sell some furniture that had been damaged by fire. He sold it at 15% less than it cost, and received \$191.25 for it. What was the cost?

GENERAL WRITTEN PROBLEMS

1. A dealer bought a quantity of ladies' shoes at a cost of $705. The selling expenses amounted to $115. He was forced to sell out the line for $738. What was the per cent of loss?

2. A printer is offered a new style press, listed at $1520, at a discount of 2% for cash. He decides to pay half cash and the balance in 3 mo. at 4% interest. How much more will the press cost him?

3. A train leaves Buffalo at 1 P.M. and arrives in Albany at 6:57 P.M. If the distance is 296.53 mi., what is the average speed of the train?

4. A man who has invested $14,500 in a bottling establishment secures a yearly income of 15% on his investment. His daughter is employed by him as a clerk at $12.50 a week; one son is a helper at $65 a month; and another son is a clerk at $75 a month. What is the total yearly income of the family from the business?

5. A dealer in works of art imported four French paintings, invoiced at 5200 fr., 1460 fr., 2920 fr., and 4650 fr. Express the total in dollars and cents.

6. A man owns a city house assessed at $16,500 and a country home assessed at $6250. If the city tax rate is $1.87 per $100 and the country rate $.72 per $100, what is the total amount of his tax bill?

7. A clothing salesman has a salary of $1350 a yr. and 2% commission on his sales. In five years his sales were: $34,300, $47,100, $37,750, $40,200, $41,400. What was his average income?

8. If a dealer buys plums at the rate of 5 for 2¢ and sells them at the rate of 4 for 3¢, how many must he buy and sell to make a profit of $8.40?

9. You bought to day from the Cadillac Motor Co.: 1½ doz. quart cans Cadillac dressing @ \$6.40, discount 10%; 4 tubes @ \$5.20 each, discount 25%; 3 tires @ \$15.50 each, discount 20%. Make out a bill for the items.

10. Write out a check on the National Trust Company in payment of the above bill.

11. Find the amount of the tax, at \$2.08 per \$100, on property assessed at \$27,500.

12. A firm's bank balance is \$818.75. It deposits \$240.39, \$168.75, \$847.13, \$1,200, \$397.93 and draws checks of \$250, \$117.72, \$480, \$127.38, \$416, and pays a bill by check for \$848.20 less 5% discount. What is their balance.

13. A dealer ordered goods to the amount of \$2800. He paid one half the bill in 10 da., securing 2% discount. On the balance of the bill he had to pay interest at 5% for 8 mo. 15 da. What did he pay in all?

14. On Dec. 12, 1917, a man borrowed \$1200 at 6% interest. What was the interest due on June 6, 1918?

15. A lady bought a set of furs in London for £54 15s. 10d. What was the cost in our money?

16. On an electric fan listed at \$8, a trade discount of 20, 10, and 5% is made. What is the selling price?

17. On July 1, 1913, a man loaned \$650 at 5½%. What was due Jan. 1, 1915?

18. A hotel keeper has been paying \$38.80 per 100 lb. for creamery butter. He is notified that the price will be advanced to \$46.56. Find what per cent more he will have to pay.

19. A man borrowed \$960 at 6% interest. What is the amount due at the end of 1 yr. 3 mo. 24 da.?

20. Make out a bill from John Wanamaker for: $5\frac{1}{2}$ yd. lace @ 29¢; 4 pr. stockings @ 69¢; $12\frac{1}{2}$ yd. ribbon @ 56¢. Then make out the check in payment of the account.

21. A furniture dealer buys dining room chairs at $30 a doz. with a discount of 20%. He sells these at retail for $2.50 each. Find the gain per cent.

22. It costs a manufacturer $720 to produce a printing machine. He adds 25% to the cost as his profit and $52 shipping charges for export to Hamburg. What is the exact amount of his bill in German money?

23. What is the difference between a discount of 10% and two successive discounts of 5% each on a bill of $832?

24. The last reading of a gas meter was 67,300 cu. ft.; the previous reading was 64,900 cu. ft. At $1.35 per thousand cu. ft., what is the amount of the gas bill?

25. An agent sold a consignment of 2000 bbl. flour at $5.60 a bbl. He paid $73 for storage and $27 for carting. How much should he remit after deducting commission of $\frac{1}{2}$%?

26. John Wanamaker wished to order 50 gal. of perfume in France. How many liters did he order?

27. An American merchant purchased a piece of velvet in Lyons, France, for $92.50; if the piece contained $32\frac{1}{2}$ meters, what did the velvet cost per yd.?

28. Mt. Everest is approximately 8842 meters high. Find its height in feet.

29. A New York merchant imports 5 Kl. of olive oil. How many quart bottles can he fill with it?

30. If the distance between two cities is 125 mi., how far is it in kilometers?

ARITHMETIC BY GRADES

SEVENTH YEAR BOOK

SECOND HALF: GRADE 7B

I. DRILL IN FUNDAMENTAL OPERATIONS

WRITTEN EXERCISE

Add by columns and by rows across: check totals:

	1.	2.	3.	4.	5.	
6.	$486.75	+ $546.31	+ $203.46	+ $535.46	+ $786.32	=
7.	90.35	+ 180.43	+ 147.14	+ 322.90	+ 472.28	=
8.	636.41	+ 88.97	+ 511.11	+ 273.40	+ 177.73	=
9.	17.74	+ 205.63	+ 623.84	+ 522.48	+ 522.50	=
10.	549.63	+ 487.08	+ 809.76	+ 28.45	+ 183.85	=
11.	742.96	+ 926.11	+ 27.36	+ 682.68	+ 74.71	=
12.	585.41	+ 42.49	+ 313.01	+ 192.31	+ 373.72	=
13.	99.84	+ 103.25	+ 222.26	+ 857.80	+ 472.08	=

	14.	15.	16.	17.	18.	
19.	$8297.63	+ $5400.08	+ $7971.25	+ $6843.52	+ $3679.28	=
20.	1424.08	+ 1397.89	+ 9793.40	+ 342.69	+ 2193.62	=
21.	5071.22	+ 4431.81	+ 271.56	+ 4950.02	+ 2739.41	=
22.	483.76	+ 342.58	+ 1843.25	+ 9188.26	+ 89.49	=
23.	7714.23	+ 5234.45	+ 7240.08	+ 3046.05	+ 771.25	=
24.	1884.69	+ 3729.32	+ 1397.79	+ 247.41	+ 3479.32	=
25.	592.41	+ 211.21	+ 500.08	+ 4726.11	+ 4125.81	=
26.	6080.42	+ 1998.14	+ 2842.35	+ 3045.12	+ 8991.24	=

Subtract:

27. 87,012 59,986	**29.** 263,113 185,986	**31.** 732,225 248,678	**33.** 200,043 179,859
28. 608,007 59,978	**30.** 210,072 196,785	**32.** 234,437 156,758	**34.** 108,041 103,592

35. 236,452 − 164,562 + 125,190 + 789,764 − 211,690 =

Multiply:

36. 848 by 80	**41.** $16\frac{1}{2} \times \frac{3}{11} \times \frac{1}{2} \times 480$	**46.** .873 by 600
37. 840 by $33\frac{1}{3}$	**42.** $3\frac{1}{2} \times 4\frac{1}{4} \times 84$	**47.** 4254 by $16\frac{2}{3}$
38. 378 by 700	**43.** $85 \times \frac{2}{5} \times \frac{7}{34}$	**48.** 8203 by .402
39. 2.12 by .087	**44.** $\frac{3}{8} \times 64{,}000$	**49.** 7246 by 185
40. 480 by $12\frac{1}{2}$	**45.** $2.25 \times 12{,}000$	**50.** .087 by 756

Divide:

51. 16,672 by 32	**56.** 1928.16 ÷ 4.12 ÷ 1.3 ÷ 15
52. 142.12 by 4.4	**57.** 32.67 ÷ .33 ÷ .12 ÷ 25
53. 382.69 by 49	**58.** 15724.8 ÷ .4 ÷ 3.9 ÷ 21
54. .21264 by .16	**59.** 712245.6 ÷ 11 ÷ 92 ÷ .9
55. 60.092 by .724	**60.** 2429.168 ÷ .7 ÷ .41 ÷ 92

Short Methods.

ORAL EXERCISE

Multiply by 10; *by* 100; *by* 1000:

1. 3.22	**3.** 18.25	**5.** .38	**7.** .0367	**9.** 475.38
2. 82.36	**4.** .09723	**6.** 250.16	**8.** .0004	**10.** 55.630

Multiply by 20; *by* 30; *by* 200; *by* 300:

11. 1.20	**12.** .15	**13.** 2.25	**14.** .06	**15.** 20.2

Divide by 10; *by* 100; *by* 1000:

16. 842	**18.** 26.5	**20.** 730	**22.** 8800	**24.** 25,200
17. 1.16	**19.** 3.8	**21.** 48.1	**23.** 35,171	**25.** 12,620

Divide by 20; *by* 30; *by* 200; *by* 300:

26. 18 **27.** 120 **28.** 24 **29.** 360 **30.** 48,000

To Multiply by	MULTIPLY BY	AND DIVIDE BY	To Divide by	MULTIPLY BY	AND DIVIDE BY
5	10	2	5	2	10
50	100	2	50	2	100
25	100	4	25	4	100
125	1000	8	125	8	1000
$12\frac{1}{2}$	100	8	$12\frac{1}{2}$	8	100
$33\frac{1}{3}$	100	3	$33\frac{1}{3}$	3	100
$66\frac{2}{3}$	100 or 200	6 or 3	$66\frac{2}{3}$	6 or 3	100 or 200

WRITTEN EXERCISE

Multiply each of the following by 5 *and by* 50:

Divide each of the following by 5 *and by* 50:

1. 350 **2.** 42.4 **3.** 1.25 **4.** .324 **5.** 82.8

Multiply each of the following by 25 *and by* $12\frac{1}{2}$:

Divide each of the following by 25 *and by* $12\frac{1}{2}$:

6. 4.8 **7.** 65.6 **8.** 96.8 **9.** 785 **10.** 7.44

Multiply by $33\frac{1}{3}$; *then divide by* $66\frac{2}{3}$:

11. .96 **12.** 9.24 **13.** 2.46 **14.** 63.6 **15.** 900

16. 25 cows yielded, in one year, 562,844 pounds of milk. What was the average yield per cow?

17. How many five-dollar gold pieces can be minted from $3,465,985 worth of gold, if the coin is minted $\frac{11}{12}$ fine?

18. During 50 weeks the United Kingdom bought $64,342,561 worth of lubricating oil. What was the average value of the oil bought every week?

19. Deposits in banks amounted to $120,000,000. If this sum was distributed among 125 banks, what was the average deposit in each bank?

20. The total value of 125 steamers sunk during the Great World War was $52,416,825. What was the average value?

WRITTEN EXERCISE

Find the costs:

1.	1944 yd.	@ $.16⅔	6.	456 ft.	@ $1.37½
2.	1172 lb.	@ .25	7.	984 yd.	@ .62½
3.	837 ft.	@ .33⅓	8.	1536 lb.	@ .87½
4.	1984 lb.	@ .75	9.	2472 yd.	@ 1.12½
5.	2472 yd.	@ .12½	10.	1347 yd.	@ 2.66⅔

REVIEW OF FRACTIONS AND DECIMALS

1. From 37 yd. of cloth, a salesman sold 9¾ yd., 15⅜ yd., ⅝ yd., and 3⅝ yd. How many yards has he left in the piece?

2. A traveler journeyed $\frac{5}{24}$ of his way by rail, ⅜ by water and the remainder by automobile. What part of the trip was made by automobile?

3. Of a 10-gallon can of syrup, ⅓ was used at one time, and ⅝ of the remainder at another. How many gallons remained in the can?

4. A piece of tin is 9¾ in. long and 7⅖ in. wide. How many square inches does it contain?

5. Paul weighs 96⅜ lb. His cousin weighs 11½ lb. more then Paul and $16\frac{3}{16}$ lb. less than Sarah. How much does the cousin weigh? How much does Sarah weigh?

6. In a race, an automobile traveled a mile in 28⅔ seconds. At this rate, how long did it take to cover the course of 32 miles?

7. A grocer puts 3¾ lb. of sugar in a package. How many packages can be made from 397½ lb. of sugar?

8. If it requires $4\frac{3}{4}$ yd. of silk to make a blouse, how many blouses can be made from a piece of silk 70 yd. long?

9. If a cubic foot of water weighs $62\frac{1}{2}$ lb., what is the weight of the water in a tank 10 ft. long and 8 ft. wide, the water being $6\frac{1}{2}$ ft. deep?

10. How many feet of ribbon are needed to make 4 dozen badges, each badge requiring $8\frac{5}{8}$ in. of ribbon?

11. Find the per cent difference in value between our five-dollar gold piece and an English sovereign worth \$4.8665.

12. A dozen persons hire an automobile bus for \$18. How much more must each pay than if the party were fifteen in number?

13. A factory costing \$22,500 rents for \$2400 a year. The taxes and repairs amount to \$600 a year. What is the per cent of net income on the investment?

14. How many pairs of boxing gloves at $\$1.12\frac{1}{2}$ a pair, can be purchased for \$40.50?

15. A storekeeper buys eggs at $32\frac{1}{2}$¢ a dozen, and sells them at the rate of 10 eggs for 40¢. What is his profit on 200 doz. eggs?

16. The area of a rectangle is 13.14 sq. ft., and its altitude is 2.37 ft. How long is it?

17. One cubic foot of water weighs $62\frac{1}{2}$ lb. If lead is 11.3 times as heavy as water, how many pounds are there in a cu. ft. of lead?

18. If the average speed of a train is 25.6 mi. an hour, how long will it take to travel 2056 mi.?

19. About .04 of any quantity of milk is cream. At this rate, how many qt. of cream are there in 964 qt. of milk?

20. If a steamboat makes 23.40 mi. an hour, how far will it go in 14.75 hr.?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Find the areas of these rectangles:			*Divide:*	
1.	2 ft. × 3 in.	25″ × 6″	$3\frac{1}{2}' \times \frac{1}{2}'$	$\frac{5}{8} \div \frac{5}{9}$	$54 \div 2$
2.	2 yd. × $\frac{1}{2}$ yd.	10′ × $5\frac{1}{2}'$	$6' \times 9\frac{1}{2}'$	$\frac{5}{6} \div \frac{1}{2}$	$85 \div 5$
3.	30 in. × $2\frac{1}{2}$ in.	4″ × $6\frac{1}{4}$″	112″ × 10″	$1\frac{1}{12} \div \frac{2}{3}$	$69 \div 3$
4.	$4\frac{1}{2}$ rd. × 3 rd.	11′ × 9′	1 yd. × 18′	$\frac{4}{25} \div \frac{7}{5}$	$84 \div 7$
5.	$6' \times 5\frac{1}{2}'$	2 yd. × $1\frac{1}{2}'$	$\frac{1}{2}$ yd. × 20 yd.	$\frac{3}{15} \div \frac{9}{12}$	$115 \div 5$

	Find the lengths: AREA	WIDTH	*Solve:*	*State the interest at 6% on:*		*Solve:*
6.	96 sq. in.	8 in.	$\frac{4}{5} + \frac{1}{2}$	\$600 for 6 mo.	\$340 for 60 da.	$\frac{2}{3}$ of $\frac{14}{15}$
7.	110 sq. in.	22 in.	$\frac{6}{7} + \frac{2}{3}$	\$300 for 8 mo.	\$600 for 90 da.	$\frac{3}{4}$ of $\frac{7}{8}$
8.	180 sq. ft.	3 ft.	$\frac{1}{22} + \frac{3}{11}$	\$320 for 1 yr.	\$300 for 120 da.	$\frac{1}{3}$ of $\frac{7}{9}$
9.	60 sq. yd.	4 yd.	$\frac{5}{18} + \frac{2}{3}$	\$400 for 4 mo.	\$1200 for 15 da.	$\frac{2}{3}$ of $\frac{9}{10}$
10.	72 sq. rd.	6 rd.	$\frac{2}{5} + \frac{3}{4}$	\$900 for 2 yr.	\$2400 for 20 da.	$\frac{1}{7}$ of $\frac{16}{21}$
11.	86 sq. rd.	2 rd.	$\frac{3}{4} - \frac{2}{5}$	\$320 for 6 mo.	\$600 for $\frac{10}{12}$ yr.	$\frac{2}{3} \times \frac{3}{5}$
12.	90 sq. ft.	18 ft.	$\frac{3}{5} - \frac{2}{7}$	\$700 for 4 yr.	\$400 for $\frac{7}{8}$ yr.	$\frac{1}{2} \times \frac{7}{10}$
13.	48 sq. in.	3 in.	$\frac{7}{12} - \frac{2}{3}$	\$200 for $1\frac{1}{2}$ yr.	\$300 for $\frac{5}{6}$ yr.	$\frac{1}{3} \times \frac{11}{12}$
14.	105 sq. ft.	7 ft.	$\frac{19}{30} - \frac{1}{2}$	\$1000 for 2 mo.	\$1200 for $\frac{3}{4}$ yr.	$\frac{3}{5} \times \frac{7}{20}$
15.	500 sq. in.	20 in.	$\frac{12}{16} - \frac{1}{4}$	\$150 for $2\frac{1}{2}$ yr.	\$1100 for $\frac{2}{3}$ yr.	$\frac{3}{7} \times \frac{14}{15}$

	Read:	*State the approximate equivalents for:*			
16.	XXIX	£70	800 M.	500 R.	600 fr.
17.	LXVI	26 lire	160 M.	350 R.	450 fr.
18.	CXIX	£40 5s.	440 M.	1000 R.	800 fr.
19.	XLIV	38 lire	860 M.	75 R.	650 fr.
20.	MDCX	£1 10s.	2000 M.	850 R.	3000 fr.

State quickly the results of the following:

21.	$\frac{48 \times 25}{12}$	$\frac{120 \times 88}{240}$	?)108 / 9	?)121 / 11	$\frac{36 \times 72}{12}$
22.	$\frac{36 \times 400}{72}$	$\frac{140 \times 110}{55}$	?)98 / 7	?)75 / 15	$\frac{96 \times 48}{24}$
23.	$\frac{64 \times 35}{7 \times 8}$	$\frac{130 \times 175}{15}$	?)128 / 3	?)141 / 3	$\frac{54 \times 81}{27}$

GENERAL WRITTEN PROBLEMS

1. A blouse required $4\frac{1}{8}$ yd. of material at \$1.50; 2 spools of sewing silk at $12\frac{1}{2}$¢; $\frac{3}{4}$ doz. buttons at 50¢. If it took a seamstress 8 hours to make this blouse and her charge was 28¢ an hour, what was the % gain at a selling price of \$12.25?

2. An expert typewriter made the following records in four trials of 1 hour each: first hour, 5974 words; second hour, 6013 words; third hour, 6134 words; fourth hour, 6103 words. What was the average per hour?

3. If barbed wire costs 2¢ a ft., what will it cost to put 5 wires around a field $42\frac{1}{2}$ rd. long and $36\frac{1}{2}$ rd. wide?

4. A merchant having a debt of \$8440 due him agrees to take 75% of the amount. If he pays an agent $2\frac{1}{2}$% for collecting the money, how much does he lose?

5. In one month, a family uses $1\frac{1}{4}$ tons of coal at \$6.80 per ton, and 3500 cu. ft. of gas at \$1 per thousand cu. ft. If the father's monthly salary is \$120, what fractional part of this does he pay for fuel and light?

6. An automobile was driven 64.4 mi. in $3\frac{1}{2}$ hr. What was the average speed per hour?

7. How many cu. ft. are there in a store room 48 ft. long, 24 ft. wide, and 12 ft. 8 in. deep?

8. Make out the bill that A. H. Keller, a plumber, sends for the following: 12 ft. galvanized pipe at 10¢ a ft.; 6 galvanized elbows at 11¢ each; 1 faucet at \$1.25. The charges for labor were 75¢ an hr. for $3\frac{1}{2}$ hr. Receipt the bill.

9. A boy sold 94 papers every day except Sunday. His profit was one half of a cent on each paper. What was his profit for the month of August?

(31 days including 4 Sundays.)

10. Find the amount of the following bill:

75 yd. flannel @ $37\frac{1}{2}¢$; 84 yd. cotton @ $7\frac{1}{2}¢$;
64 yd. buckram @ $9\frac{1}{2}¢$; 27 yd. canvas @ $62\frac{1}{2}¢$.

11. A business man received £88 in payment of a bill. At an exchange rate of $4.8665, how much will he deposit in his bank?

(What is meant by the expression **Exchange?** *See p. 71.*)

12. A consignment of tomatoes to a commission merchant was made up of 264 baskets, each containing 1 pk. 4 qt. What was the net value of these if sold at 30¢ a bushel, the merchant's commission being $2\frac{1}{2}\%$?

13. If $2.25 per gross is paid for school pencils, what will be the cost of the pencils for 96 pupils, that each pupil may have one pencil?

14. A workman used only $\frac{3}{8}$ of the copper wire he brought to repair an electrical machine. If he returns to the shop with 12 ft. 6 in. of wire, how much has he used?

15. After the brakes are applied the wheels of a fire engine revolve $9\frac{1}{2}$ times before the engine comes to a standstill. If the wheels are $20\frac{4}{5}$ ft. in circumference, in what distance is the engine stopped?

16. The value of the gasoline and naphtha exported by the United States in one week was $8,489,512. At this rate, how much would be exported in 25 weeks?

17. If a meter equals 3.28 feet, how many meters in a mile?

18. At $6.45 a ton, how much will 5800 lb. of coal cost?

19. Money deposited in a savings bank July 1 or Oct. 1 draws interest at 4%, if left on deposit until the following Jan. 1. If I deposit $200 on July 1, 1917 and $145 on Oct. 1, 1917, how much will I have to my credit after the interest is added Jan. 1, 1918?

II. APPLICATIONS OF PERCENTAGE

PROFIT AND LOSS

ORAL PROBLEMS

1. A box of grapefruit that cost \$4.80 was sold at a loss of $12\frac{1}{2}\%$. What was the selling price?

2. A storekeeper sells neckties at one dollar each. 65% of the dollar goes to pay the manufacturer and 16% to pay overhead charges. What is the profit on each necktie?

3. Eggs which cost a dealer 36¢ a doz., are sold at a gain of $16\frac{2}{3}\%$. What is his profit on 10 doz.?

4. At what price must hats that cost \$1.50 be sold in order to gain 20%?

5. A man sold his phonograph at a loss of 15%. If he had paid \$30 for it, what was the loss and the selling price.

6. A butcher paid 25¢ a lb. for fowl and was forced to sell it at 22¢ a lb. What was the per cent of loss?

WRITTEN EXERCISE

Find the gain or loss, and the selling price:

	COST	GAIN	LOSS		COST	GAIN	LOSS
1.	\$1425	20%		5.	\$ 118.80		75%
2.	828.55	16%		6.	435.25	5%	
3.	984.10		22 %	7.	1065		26%
4.	4256		$12\frac{1}{2}\%$	8.	776.05	8%	

9. What do you understand by the expression **overhead charges** or **overhead?** Are selling expenses part of overhead?

10. What is the general rule for reckoning **profit and loss?** Do you know of any other method?

WRITTEN PROBLEMS

1. A department store buyer purchased 450 yd. of dress goods at \$1.60 a yd. The department's share of overhead charges was \$84.25. The goods were sold at a profit of 28% on the total cost. What was the profit and the selling price?

2. A druggist bought 72 doz. boxes of stationery for \$172.40 and sold them at a profit of 25%. How much did he receive for each box?

3. A dressmaker made $2\frac{1}{2}$ doz. shirtwaists. Each shirtwaist required 3 yd. of silk at \$1.40 a yd., and the cost of making was \$16 a doz. If the waists were sold for \$850. What was the gain on each?

4. A business man invested money in a laundry to the amount of \$11,184. At the end of a year his bookkeeper computed his profit at $31\frac{1}{4}$% on the investment. How much was his profit?

5. A publisher was forced to sell for \$13,520 his stock of books that had cost him \$18,750. What was the rate of his loss?

6. By investing \$22,400 in a factory building, a man made a profit of \$3200 a year. What per cent was his investment earning for him?

7. A dealer bought one half a carload of coal, 10,000 lb., at \$5.60 a ton. He sold it and gained 40% on his investment. How much did he receive for all the coal?

8. A boy sold a new pair of ice skates for \$.75 more than he paid for them. By doing this, he gained 15% on the cost. How much did he pay for them?

9. A land speculator made a profit of 26% by selling a farm for \$1430 more than he paid for it. What did the farm cost him and how much did he receive for it?

10. A manufacturer sold harvesting machinesat $1100 each to a foreign government. By securing this price, he made a profit of 25%. What did it cost him to make the machines?

11. A house which was sold at a gain of 25%, brought $2500. What was its cost?

12. A man bought a house for $3500. He lived in it for 1 yr. 6 mo. and sold it for $4000. If he had sold it 3 mo. earlier, he could have gotten $4200. If rentals in his neighborhood were $30 per month, did he gain or lose? How much?

COMMISSION

ORAL PROBLEMS

1. An agent was allowed a commission of 6% for selling goods worth $3300. What was his commission?

2. If a person sells $193 worth of gymnasium apparatus on a commission of 10%, how much will he earn?

3. What is the commission on a real estate sale of $10,000, at $2\frac{1}{2}\%$?

4. An agent secured $640 for a second hand piano, charging $80 commission. At what rate was this?

5. An agent buys $2400 worth of goods and secures $\frac{1}{2}\%$ commission. What is his commission?

6. A commission merchant sold California grapes for $1800, and charged $90 commission. What rate did he charge?

WRITTEN EXERCISE

1. A salesman receives 8% commission on the orders he takes. On one trip he sells goods to the amount of $7600. How much did he earn on this trip?

2. A commission merchant receives a carload of 150 bbl. of apples to be sold at $6.50 a bbl. What will his commission be at 3%?

Find the commission on the following sums at the rates given:

	SUM	RATE		SUM	RATE
3.	$ 845	3%	**9.**	$7632.15	$1\frac{1}{4}$%
4.	12,400	$\frac{1}{2}$%	**10.**	4240	$5\frac{1}{4}$%
5.	5420	8%	**11.**	1938.24	25%
6.	880	14%	**12.**	1248	$3\frac{1}{3}$%
7.	8436	$12\frac{1}{2}$%	**13.**	3720	12%
8.	625.50	5%	**14.**	2500	$2\frac{1}{2}$%

15. A real estate agent sold a factory building for $13,200. His commission was $2\frac{1}{2}$%. How much did the owner receive?

16. A business man turned over to a collection agency unpaid bills amounting to $2800. The agency charged 2% for collecting $\frac{1}{2}$ of the amount and 5% for collecting the other half, which was more troublesome. How much did the merchant receive?

17. A buyer sends $2390.85 to his agent to invest in flour. After deducting as commission $3\frac{1}{2}$% of the amount received, how many bbl. of flour can the agent buy at $5.50 a bbl?

18. An agent received $18.10 for collecting a debt of $362. What was his rate of commission?

19. A traveling salesman receives a salary of $30 a week and a 3% commission on his sales. If his sales amount to $6000 a month, counting four weeks to the month, how much is his income?

20. An agent was able to collect 48% of a debt amounting to $7200. What was his commission at 3%?

21. Through an agent a merchant buys 120 lb. of tea at 60¢ and pays $1.44 commission. Find the rate of the agent's commission and the net cost of the tea to the buyer.

22. A commission merchant sold produce for a farmer, and remitted to him $142.50. If the merchant deducted $7.50 as his commission, what was the selling price? What was the merchant's rate of commission?

23. A salesman sold 15 rockers at $5.25, 3 library tables at $44.50, 1 lamp at $5.25, and 5 sets of porch furniture at $36.50. What was the rate of commission if the salesman received $18?

INSURANCE

Insurance Companies. These great companies are organized to protect people against loss by fire, death, accident or sickness, and the many casualties incident to ocean shipping. The companies collect small fees from the many thousands of insured persons and corporations; by the accumulation of these fees, the companies have always a large **surplus** on hand. From this surplus, they are able to pay the fairly large sums that are occasionally required to meet the losses that come to their members. For example: A man may insure his factory for $25,000; he may have paid only one **premium**, at the rate of $1.20 per $100, or $300. Should, however, that factory burn during the year, he would receive the full amount of the policy, if the factory and its contents became a total loss. But, comparatively few fires are total losses; in case of a partial loss, the payment of the company will be **pro rata**; that is, for the percentage of loss an equal percentage of payment will be made.

Without insurance, it would be practically impossible to carry on business. By means of insurance, the business man can risk very much more of his capital for the furtherance of his business than he would dare to do were he not protected against sudden losses.

Explain the meaning of: **Fire, Life, Accident, Marine Insurance.**

ORAL EXERCISE

1. If the rate of insurance is 70¢ per thousand, what is the premium on a policy for $4000? For $300? For $1050?

2. What is the premium on a policy for $6200 at 50¢ per $100?

3. If you insure a house for $8000, what is the premium at $1.20? At 40¢?

WRITTEN EXERCISE

1. A hotel worth $45,000 is insured for $\frac{1}{2}$ its value at $1.10. Find the premium.

(The rate of insurance is understood to be on $1000, unless stated to the contrary.)

2. An automobile truck valued at $5000 was insured for 80% of its value at $1.40. What was the premium?

3. A man insured a country house valued at $55,000 for $\frac{3}{5}$ of its value at 60¢. What was the premium?

4. A ship is insured for $75,000 and its cargo for $48,000. What is the premium at $1.15?

5. A powder factory valued at $250,000 is insured at the rate of $1.25 per $100. What is the premium?

6. Leather goods worth $9000 are insured for $\frac{2}{3}$ of their value. Find the rate if the premium is $144.

7. If $72 is paid as premium on a policy for $4800, what is the rate of insurance?

Life Insurance. A man insures his life for $7000 and pays his annual premiums regularly. This means that, when he dies, his family or those dependent upon him will receive from the insurance company $7000. In life insurance, the premiums are stated as so much upon each $1000 of insurance. The younger a person is when he takes out a policy, the lower is the rate of insurance that he must pay. In an **endowment policy**, the premiums are paid for a fixed number of years, like fifteen or twenty; besides, the policy is looked upon as a form of **savings** and a higher rate is paid than upon a **straight life policy**. At the end of the time stated in the policy, the company will pay to the insured the full amount of the policy; should the insured die before the expiration of that time, the company will pay to the family or dependents of the insured the amount of the policy. Therefore, the endowment is both an insurance and a savings.

WRITTEN EXERCISE

1. A man takes out a $6500 policy at $28.50. What is his annual premium?

2. How much is paid in yearly premiums on a life policy for $8000 if the rate is $18.60?

3. A woman takes out a 20-year endowment policy for $4000. If the rate is $48.90, how much does she pay in premiums in the twenty years?

4. If a man pays an annual premium of $168 on a policy for $6000, what is the rate per $1000?

5. A man took out a policy for $3000 at $32.60. He died before the fifth annual premium was due. How much did his family receive above the amount he had paid as premiums?

6. A man pays an annual premium of $540 on his policy. If the rate is $27, what is the face of the policy?

7. Suppose you take out a 20-year endowment policy for $5000 at $48.48. How much will you have paid in before your policy becomes due?

8. A man takes out two policies: one, a straight life of $1000 at $28; the other a 20-yr. endowment of $1000 at $45.50. If he dies just before the end of the sixth year, how much over what he has paid out does the company pay his widow?

DISCOUNT

WRITTEN EXERCISE

1. The school team buys baseball supplies amounting to $65. If the school gets a discount of 4%, how much will the supplies cost?

2. A salesgirl bought a pair of gloves in her store at $2, and got a discount of 8%. How much did the gloves cost?

Find the net prices of the goods, with the list prices and discounts given below:

3. $4000; 15%
4. $250; 8%
5. $4500; 12½%
6. $835.50; 10%
7. $620; 6%
8. $5500; 2%

9. A buyer is offered 3% off for cash, or 1% off for payment in 20 days, on a large purchase of rubber goods. What is saved on a $3300 order of goods by paying cash?

10. A man receives a bill amounting to $885.20, and finds that his regular discount of 3% has not been allowed. What is the net amount of his bill with the regular discount granted?

11. A dealer orders a supply of goods amounting to $3450. The terms are 90 days net, 3% 10 days. How much does he lose by waiting 2 mo. before settling the bill?

12. One store offers to supply a school with a basketball outfit for \$83.20 with $\frac{1}{8}$ off; another offers the outfit for \$77.50, discount at 3%. Which is the better offer and how much can be saved by taking it?

13. In paying a bill of \$1025 for machinery, a merchant sent a check for \$1000. Find the rate of discount of which he took advantage.

14. A police officer purchased a revolver for \$12. His bill amounted to \$11.40, what was the rate of discount that he secured?

15. A dry goods store buys on an average \$9500 worth of goods a month. By paying cash, it receives a discount of $2\frac{1}{2}$%. How much is saved a year by paying cash?

SUCCESSIVE DISCOUNTS

You have learned that a buyer may receive on goods that he purchases two or more discounts. For example: automobiles may be listed in the manufacturer's catalogue at \$2250, with a dealer's discount of 20%. Market prices may be lower, and a further discount of 10% may be granted the dealer. Should a third discount be allowed, it will be computed upon the amount left after the other two discounts have been deducted.

Theoretically, these discounts ought to be deducted in their proper order; for the sake of analysis, it will be well for you to do this; but, practically, it makes no difference, in the final result, what order is used in making the deductions.

(To prove this, test a few examples.)

The order in which the successive discounts are deducted does not affect the result.

Often, you will have occasion to figure a bill of goods in which there may be many items, several of which are with the same discount. It will shorten the work, incidentally add to accuracy, if you group all such items, and figure the discount on the totals of each group.

\$10, 3%; \$5, 2%; \$7.50, 2% =
\$10, 3%; \$5 + \$7.50 = \$12.50, 2%.

Study carefully the following methods of finding the **net price**:

\$2250 = List Price
450 = 20% Disct
1800
180 = 10% Disct
\$1620 = Net Price

\$2250 = List Price
× .80 = (100% − 20%)
1800
× .90 = (100% − 10%)
\$1620 = Net Price

\$2250 = List Price
× .72 = Total Disct
\$1620 = Net Price

If the discount is 20%, then 80% is the new price, after deducting the first discount.

As 10% is allowed on this 80%, or 8%, deduct 8% from 80%; the remainder, 72% of the catalogue price is the final selling, or **Net Price.**

ORAL EXERCISE

Find the discount and the net price:

1. \$500; 10% and 1%.
2. \$100; 20% and 10%.
3. \$200; 25% and 10%.
4. \$3000; 10% and 5%.
5. \$2000; 10% and 2%.
6. \$6000; 33⅓% and 10%.
7. A piano, listed at \$500, was sold at discounts of 20 and 10%. What was the total discount? What was the net price?
8. A girl bought a typewriter at \$50, with discounts of 10 and 10%. What did she pay for it?

9. On a 100-dollar set of books, a lady was offered 10 and 5% off. What did the books cost her?

10. What is the difference in the cost of a bicycle offered at \$100, with discounts of 10 and 10% off, or with a straight discount of 20?

11. The list price is \$125; discounts are 25 and 5%. What is the net price?

12. The list price is \$30; the discounts are $33\frac{1}{3}$ and 25%. What is the net price?

WRITTEN EXERCISE

1. How much more does a dining room set cost if marked \$76.50 with a discount of 20%, than one marked \$59.75 without discount?

2. A merchant bought goods listed at \$472 and was allowed discounts of $12\frac{1}{2}$, 10, and 2%. How much did he pay for the goods?

3. What will be the cost of 15 dozen electric lamps listed at \$8 a doz. with discounts of 40, 20, and 10%?

Find the net prices:

	LIST	DISCOUNT		LIST	DISCOUNT
4.	\$600	20 and 10%	10.	\$1000	10, 5, and 2%
5.	\$620	12 and 2%	11.	\$1200	10, 10, and 10%
6.	\$820	40 and 5%	12.	\$1500	$33\frac{1}{3}$, 10, and 2%
7.	\$960	30 and 2%	13.	\$2500	25, 25, and 5%
8.	\$720	30 and 3%	14.	\$3000	$16\frac{2}{3}$, 10, and 3%
9.	\$880	$12\frac{1}{2}$ and 2%	15.	\$5000	25, 5, and 2%

16. A grocer bought 625 doz. pound-packages of crackers for \$900, less $16\frac{2}{3}$%. He sold each package for 16¢. How much did he gain in all?

17. Which is cheaper for the purchaser and by how much: two successive discounts of 25% and 10% on a bill of \$500 or a single discount of $33\frac{1}{3}\%$?

18. What will be the net cost of a piano marked \$450 with trade discounts of 3, 8, and 10%?

19. On a piece of machinery listed at \$12, discounts of 20, 10, and 5% are made. What is the selling price?

20. What is the difference between a discount of 40% on \$1800 and the three discounts of 20, 10, and 10%?

Discount Sheet. When prices as listed in the manufacturer's catalogue are to be lowered to the dealer, the manufacturer sends out to all his customers a discount sheet. This shows the catalogue numbers and the discounts as granted against each number. It is understood that the dealer must keep this discount sheet for his private use, and must never allow his retail customers to see it.

DISCOUNT SHEET

This discount sheet is private information for the retail dealer and must not be shown to customers.

LIST NO.	DISCOUNTS		
2654	40	20	10
2756	25		5
2798	50		
2890	15	10	5

To Find a Single Discount Equal to Successive Discounts: A business man often wishes to know what single discount is equal to two or more discounts. For example: He may be offered discounts of 20 and 10%, or a straight discount of 25%. He wishes to find out quickly which is the better offer.

What single discount is equal to discounts of 30 and 10%?

$30\% + (10\% \text{ of } 70\%) = 37\%$. Deducting a discount of 30% from the list price, leaves 70% as the price. Deducting 10% from that 70%, gives 7% as the second discount.

Therefore, the total discount is 30+7, or 37%

ORAL EXERCISE

Find a single discount equal to each of the following successive discounts:

1. 40 and 30%
2. 30 and 30%
3. 25 and 20%
4. 40 and 30%
5. 20 and 50%
6. 60 and 25%
7. 10 and 40%
8. 40 and 5%
9. 15 and 10%
10. 20 and 10%

WRITTEN EXERCISE

1. A dealer offers me discounts of 10 and 10%. Another offers me a straight discount of 15%. What is the better offer?
2. What is the equivalent single discount for 20, 10, and 5%?
3. What is the equivalent discount for 20, 20, and 20%?
4. What is the single discount that equals 25, 20, and 10%?
5. One dealer offers 50 and 10% discount; another offers 30 and 25%. Which is the better offer, and by how much?
6. Which is the better for the buyer of an electric motor priced at $480, a single discount of 40%, or 20, 15, and 10%?

Marked Price of Goods with Discount. Whenever dealers allow a discount on their goods, it is usually at such a rate as still to allow them a profit. The goods, even when sold at a discount, are not sold below the cost at a loss. It is often important for a business man to know at what price he must mark his goods, that he may allow a discount from that marked price, and still make his regular per cent of profit.

A storekeeper buys ladies' blouses at \$6. At what price must he mark them that he may give a discount of 20% and still gain $33\frac{1}{3}\%$?

\$6 = Cost
2 = Gain ($33\frac{1}{3}\%$)
\$8 = *Net Selling Price*

\$8 ÷ .80 = \$10 = **Marked Price**

A gain of $33\frac{1}{3}\%$ is \$2, making the net selling price \$8.
As the dealer allows a 20% discount, he sells for 80% of the marked price.
Therefore, \$8 is 80% of the marked price.

WRITTEN EXERCISE

1. At what price must a dealer mark a typewriter that cost him \$60, that he may allow 10% discount and still make 20%?

2. A merchant pays \$16 each for arm chairs. At what price must he mark these to take off $16\frac{2}{3}\%$ and make a profit of 20%?

3. A manufacturer sells machinery, at \$450 less 20%. How should the retailer mark the engines to sell at 25% discount and still make a profit of 50%?

4. A rug was purchased by a dealer for \$300. How must he mark this to gain $16\frac{2}{3}\%$ and allow a discount of $12\frac{1}{2}\%$?

5. A dealer pays \$30 for bicycles, less 20%. At what price must he mark them to gain 20% and offer a discount of $33\frac{1}{3}$%?

6. If a dealer offers a discount of 10% from the marked price, at what per cent of the marked price does he sell? If he makes a profit of 29%, at what per cent of the cost does he sell?

How much above cost must a dealer mark goods that he may allow a discount of 10% from the marked price and still make a profit of 20%?

90% of the marked price = 120% of the cost.

$1.20 \div .90 = 133\frac{1}{3}$% of the cost.

Therefore, the goods must be marked $33\frac{1}{3}$% above cost.

How much above cost must a dealer mark goods in order to take off:

7. $16\frac{2}{3}$% and still make a profit of 20%?
8. 25% and still make a profit of 50%?
9. $33\frac{1}{3}$% and still make a profit of 20%?
10. 20% and still make a profit of 10%?

TAXES

ORAL EXERCISE

1. What is the difference, if any, between a tax rate of 18 mills and one of .018?

2. If the tax rate is 17 mills, how much are the taxes on property assessed \$10,000?

3. A tax rate in a certain city is $1\frac{1}{4}$%. How many mills is this? What is this rate on \$100 of assessed valuation?

4. Is there any difference between a tax rate of 17 mills and one of \$1.70 per \$100?

Find the amount of the taxes on the following properties at the rates as given:

5. \$4000 at 8 mills.
6. \$8000 at 15 mills.
7. \$2000 at 26 mills.
8. \$5000 at 16 mills.
9. \$2500 at 16 mills.
10. \$10,000 at \$1.10.
11. \$40,000 at \$1.50.
12. \$10,000 at \$.005.
13. \$20,000 at \$1.90.
14. \$100,000 at \$2.25

WRITTEN EXERCISE

1. What are the taxes on eight lots assessed at \$900 each, the tax rate at \$1.75 per \$100?

2. If a tax rate is \$2.12, how much taxes must be paid on a piece of property assessed at \$18,000?

Find the amount of the taxes on the following properties at the rates given:

3. \$4800 at \$1.25
4. \$9700 at 18 mills
5. \$1200 at 9½ mills
6. \$2400 at \$1.70
7. \$16,000 at \$11.20
8. \$32,300 at \$1.90
9. \$50,000 at \$1.81
10. \$42,500 at \$10.40

(Note that taxes are quoted as a per cent on the dollar, or on each 100 dollars, or on each 1000 dollars.)

11. The tax rate of a city was reduced from \$1.91 to \$1.83 per \$100. What would the reduction amount to on a property assessed at \$55,000?

12. The assessed valuation of the property in a town is \$320,000. If the tax to be raised is \$8000, what is the rate of taxation?

13. The value of a residence is \$6000. It is assessed at 75% of its value. If the tax is \$90, what is the rate of taxation?

The National Revenues: Tariff or Duties. The United States spends about $900,000,000 a year, in normal times, for the maintenance of our army and navy, for the payment of pensions, for the support of the Indians, and for payment of the salaries of thousands of officials, etc.

Citizens are not taxed directly upon their properties to raise this great sum, as they are by the state, county, and city governments.

The National funds are raised from these sources:

(*a*) **Customs Revenue—the Tariff or Duties;**
(*b*) **Internal Revenue Taxes;**
(*c*) **Income Tax.**

The customs revenues, or tariff, or duties are collected upon goods brought into the United States from foreign countries; the internal revenue taxes are collected upon certain goods manufactured in this country, like liquors and tobacco, the payments of which are usually represented by green stamps affixed to the bottles or boxes or cartons in which the goods are contained; the income tax is levied upon the incomes of individuals, partnerships, and corporations, whose incomes exceed certain fixed amounts.

The Tariff or Duties. Imported goods, when unloaded from vessels at any of our **ports of entry**, such as New York, Philadelphia, Boston, New Orleans, San Francisco, Honolulu, etc., are appraised by inspectors in the U. S. Customs Service.

Congress provides a regular schedule of the rates of customs duties to be collected upon imported goods. This list is called a **tariff.**

All imported goods fall under one of the following classes:

(*a*) **The Free List.** Certain goods are admitted free of duty into this country: coal, kerosene, carbolic acid; rubber; paper for newspapers; boots and shoes; coffee; meats, eggs, and milk.

(*b*) **Ad Valorem Duty.** Goods that are charged in this class are subject to a duty based upon the **valuation** or **marked value** in the country from which they came. This duty is reckoned as a per cent. Automobiles are subject to a duty of 45% of their value; bicycles, 55%; umbrellas, 35%; candy, 25%; chocolate, 8%. Notice very especially that the duty is based largely upon whether the goods be luxuries or necessities.

(*c*) **Specific Duty.** This duty is based upon the number of articles imported, or upon their weight. For example: champagne is subject to a duty of \$9.60 per dozen quarts; pineapples, 35¢ per 1000; apples, 10¢ per bushel; rice, 1¢ per pound; castor-oil, 12¢ per gallon; pens, 8¢ per gross; marble, 50¢ per cu. ft. Here, also, the fact that the goods are luxuries or necessities enters into consideration.

(*d*) Some goods are subject to both ad valorem and specific duties. For example: cigars are subject to a duty of \$4.50 per pound and 25% ad valorem.

Figuring Duties. Duties are figured by U. S. customs officials on *even* dollars only. That is, each fraction of a dollar less than fifty cents is disregarded; each fraction of a dollar more than fifty cents is counted as a dollar. For example: the duty value of \$5382.30 worth of furs is \$5382; the duty value of \$462.85 worth of chemicals is \$463. This is done to avoid fractions of a cent and the rule should be observed in solving all problems in duties.

Before a specific duty is figured, the customs officials allow for the weight of the case, box, or bag in which the goods are packed. This allowance is called **tare.**

The difference between the total weight and the tare is called the **net weight.**

The specific duty is figured upon the net weight.

ORAL EXERCISE

Find the ad valorem or specific duty on:

1. $1000 worth of silk neckties, duty at 45%
2. $840 worth of kitchen utensils, rate of duty 25%.
3. $2000 worth of pianos, duty at 35%.
4. $1840 worth of carpet, duty at 50%.
5. 16,000 lb. grape sugar, duty at $1\frac{1}{8}$¢ a lb.
6. $820 worth of furs, duty at 40%.
7. $2450 worth of jewelry, duty at 50%.
8. $548.80 castile soap, duty at 10%.
9. 4000 lb. butter, duty at $2\frac{1}{2}$¢ a lb.
10. $1300 worth unsweetened chocolate, duty at 8%.
11. 3000 packs of playing cards @ $.30 a pack, duty 60%.
12. $2000 worth of manufactured lace, duty at 45%.

WRITTEN EXERCISE

1. A man bought a fur coat in London for $215. The duty is 50%. How much must he pay on the coat?

2. What is the duty on 1 gross of Swiss watches worth $40 each, on which there is an ad val. duty of 30%?

3. The duty on nuts is one cent a lb. What will it cost to import 25 bbl., each containing 192 lb.?

4. The tariff on woolen blankets is 30% ad val. What is the duty on blankets valued at $485?

5. In one year the United States imported feathers and artificial flowers to the value of $8,800,000. What was the duty derived from this amount at 60%?

6. A dealer imports 3120 yd. of Belfast linen, invoiced at 35¢ a yd. Find the duty, if the tariff rate is 45%. What kind of duty is this?

7. What is the total duty on a consignment of perfumery weighing 500 lb. and valued at $1150, if there is a specific duty of 40¢ a lb. and an ad val. duty of 60%?

8. The duty on manufactured silk is 22¢ per lb. and 30% ad val. If the silk weighs 275 lb. and is worth $360, what is the total duty?

9. The duty on glass and glass ware is 45%. What was the income of the government from these imports in a year when they totalled $8,200,000 in value?

10. What is the duty on 1240 lb. of cheese valued at 15¼¢ a lb., if the tariff is 20% ad val.?

11. The duty on cotton stockings is $1.20 per doz. pairs and 30% ad val. How much is the total duty on a consignment of 250 doz. pairs worth 20¢ a pair?

12. A drug firm imports 2½ T. of bicarbonate of soda. If the duty is ¼¢ a lb., to what will the charge amount?

13. The duty on leather manufactures is 30%. If $25,085,000 worth of these goods was imported in one year, what was the amount of the duty?

14. A dealer imported from Belgium 15 cases each containing 3 dozen dolls, at a cost of 50¢ each. If the duty on toys is 35% ad val., what was the duty on the shipment?

15. How much is the duty on 13 sets of Thackeray, which cost in England £7 a set, if the duty is 15%?

16. What is the duty on a consignment of cigars, which weighs 255 lb., if the value is $3 per lb.?

17. Find the duty on 265 tubs of butter, the average weight being 56 lb., the tare 4 lb. to the tub, if the duty is 2½¢ per lb.

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Find discount and net price:		*What per cent of:*	*Solve:*	
	LIST PRICE	LIST PRICE			
1.	\$400; 20%	\$320; 10%	20 is 2¢?	$\frac{7}{8}$ is $\frac{1}{8}$¢?	714 − 29
2.	\$150; $33\frac{1}{3}$%	\$410; 5%	45 is 5¢?	$\frac{3}{9}$ is $\frac{1}{9}$ ¢?	283 − 95
3.	\$240; $12\frac{1}{2}$%	\$520; 8%	88 is 22¢?	$\frac{2}{3}$ is $\frac{6}{3}$¢?	576 − 83
4.	\$880; 25%	\$820; 2%	70 is 14¢?	$\frac{1}{2}$ is $\frac{3}{4}$¢?	435 − 46
5.	\$720; $16\frac{2}{3}$%	\$360; 4%	100 is 90¢?	$\frac{11}{15}$ is $\frac{1}{5}$¢?	685 − 97
	Find rate of discount:			*Solve:*	
	LIST NET	LIST DISCOUNT	LIST DISCOUNT		
6.	\$200; \$180	\$1200; \$30	\$3600; \$400	$\frac{3}{7}+\frac{5}{14}$	867 + 56
7.	\$100; \$80	\$240; \$20	\$7500; \$250	$\frac{2}{9}+\frac{1}{3}$	498 + 43
8.	\$800; \$750	\$210; \$70	\$1600; \$400	$\frac{4}{5}+\frac{2}{15}$	352 + 79
9.	\$600; \$540	\$1000; \$100	\$1500; \$500	$\frac{3}{11}+\frac{3}{22}$	234 + 28
10.	\$400; \$380	\$900; \$450	\$2200; \$200	$\frac{9}{10}+\frac{2}{5}$	916 + 65
	State results:				
11.	48 yd. @ $37\frac{1}{2}$¢	48 lb. @ 25¢	928 − 65	$1\frac{1}{2}\div\frac{1}{8}$	238 + 15
12.	32 yd. @ $12\frac{1}{2}$¢	16 lb. @ 75¢	463 + 51	$2\frac{4}{7}\div\frac{1}{7}$	869 − 73
13.	70 yd. @ 50¢	24 lb. @ $12\frac{1}{2}$¢	734 − 48	$1\frac{5}{9}\div\frac{2}{9}$	697 + 85
14.	40 yd. @ $62\frac{1}{2}$¢	36 lb. @ $33\frac{1}{3}$¢	489 + 73	$3\frac{1}{4}\div\frac{3}{8}$	524 − 52
15.	36 yd. @$83\frac{1}{3}$¢	24 lb. @ $87\frac{1}{2}$¢	685 − 82	$4\frac{1}{2}\div\frac{1}{10}$	482 + 26
16.	$\frac{1}{2}$ mi. = ? ft.	1 Kg. = ? lb.	2% of 600	81 ÷ 3	245 − 56
17.	? rd. = 1 mi.	1 Km. = ? mi.	8% of 140	77 ÷ 7	436 − 48
18.	1 mi. = ? ft.	1 liter = ?	7% of 810	56 ÷ 8	547 + 65
19.	1 kg. = ? lb.	12 doz. = 1?	$\frac{1}{2}$% of 800	63 ÷ 9	914 + 39
20.	2 A. = ? sq. rd.	5 pk. = ? qt..	$\frac{1}{3}$% of 1500	98 ÷ 7	783 − 93
21.	10 rd. = ? ft.	$3\frac{1}{2}$ bu. = ? pk.	$\frac{3}{4}$% of 1200	25 ÷ 5	479 + 89
22.	$4\frac{1}{2}$ lb. = ? oz.	3 M. = ?	$\frac{4}{5}$% of 1000	96 ÷ 6	639 − 53
23.	? pt. = 5 gal.	1£ = ? \$	$\frac{2}{3}$% of 1200	72 ÷ 8	847 − 67
24.	? mills = \$1	$2\frac{1}{2}$ doz. = ?	70% of 110	54 ÷ 9	428 + 58
25.	$2\frac{1}{3}$ min. = ? sec.	3 gal. = ? qt.	40% of 150	49 ÷ 7	652 + 82

GENERAL WRITTEN PROBLEMS

1. What is the amount of $8100 loaned at 5% interest from Dec. 12 to Feb. 1?

2. On a bill of goods amounting to $172.50, discounts of 25, 10, and 2% were given. What was the cash price?

3. At a charity concert, the expenses were 40% of the money received. If $250 was turned over to the poor, how much did the expenses amount to?

4. A man invested $6850 in a house. He paid 2% to the agent who bought it for him, and spent $500 on repairs. How much must he receive for the house in order to make a profit of 10% on his whole investment?

5. A plumbing-supply firm bought 840 lb. of galvanized sheet iron and was allowed discounts of 70 and 2½%. If the list price was 15¢ a lb., what was the net cost of the iron?

6. A fruit dealer bought a box of 150 oranges for $1.60. If they were sold at 20¢ a doz., what was the gain per cent?

7. A man deposited $6500 in a bank that pays 3½% yearly interest. He draws out his interest every six months. How much does he draw at each time?

8. What is the cost of 118 ladies' suits at $14 with discounts of 20 and 2%?

9. A poultry-raiser sells chickens to a butcher at 24¢ a lb. The butcher sells them at a 50% advance on the cost. How much would a customer save in purchasing a 4½-lb. chicken, if he could buy direct from the poultry-raiser?

10. 32 laborers were employed 25 days in constructing a street railway. If the total amount of wages paid was $2120, how much did each man earn per day?

11. Find the interest and amount of $2900 loaned at 6% for 120 days.

12. A man working on an average of 24 da. per month, receives \$3.75 per day. What should be his average monthly expenses to permit him to save \$300 in a year?

13. A dealer pays a factory \$220 apiece for pianos. Freight and cartage charges amount to \$12.50. At what selling price must he mark each piano to make a profit of 60%.

14. A tailor, having made a misfit coat, sold it for \$33.60. By doing this, he lost 16% of the value of the coat. What was the value?

15. A mould to support the iron work of a structure is 22′ long, 15′ wide, and 7′ deep. How many cu. yd. of cement must be mixed to fill it?

16. A storekeeper bought electric fans at \$4 with discounts of 25 and 10% and sold them at the list price. How much did he make on each fan?

17. A farm valued at \$30,000 is assessed at $\frac{2}{3}$ of its real value, and taxed at \$1.50. How much is the tax?

18. What is the ad valorem duty on 525 meters of silk, costing 6 fr. a meter, if the duty is 45%?

19. Find the total cost of: 15,500 lb. soft coal @ \$3 per ton; 9345 lb. cannel coal @ \$12 per ton; 16,375 lb. nut coal @ \$6.75 per ton; 54,190 lb. egg coal @ \$7.25 per ton; 33,675 lb. stove coal @ \$7.50 per ton.

20. Last month, John Melville deposited in his bank checks amounting to: \$789; \$6543; \$17.50; \$56.32; \$32,652. If he had a balance at the beginning of the month of \$2345.98 and paid out checks amounting to a total of \$25,987, how much is his balance now?

21. If a man speaks an average of 125 words a minute, how long will it take him to deliver a speech of 15 pages, if the pages average 28 lines, and each line 12 words?

III. BORROWING AND LENDING MONEY

INTEREST

Review of Interest.

ORAL EXERCISE

Find the interest on:

1. \$200; 6 %, 2 yr.
2. \$700; 4 %, 1 yr.
3. \$900; 3 %, 6 mo.
4. \$400; 8 %, 3 yr.
5. \$200; 6 %, 3 mo.
6. \$200; 4½%, 1 yr.
7. \$900; 4 %, 2 yr.
8. \$150; 3 %, 2 yr.
9. \$600; 4 %, 1 yr. 6 mo.
10. \$1000; 5½%, 2 yr. 6 mo.
11. \$300; 3 %, 1 yr. 4 mo.
12. \$400; 6 %, 2 yr. 6 mo.
13. \$800; 2 %, 1 yr. 3 mo.
14. \$2000; 5 %, 2 yr. 2 mo.
15. \$900; 4 %, 2 yr. 4 mo.
16. \$6000; 1½%, 1 yr. 4 mo.

Find the amounts:

17. \$400; 6%, 2 yr.
18. \$200; 5%, 1 yr.
19. \$700; 6%, 2 yr.
20. \$300; 4%, 4 yr.
21. \$2000; 3½%, 1 yr. 36 da.
22. \$500; 6 %, 3 yr. 4 mo.
23. \$4000; 4 %, 2 yr. 6 mo.
24. \$1000; 2½%, 2 yr. 72 da.

WRITTEN EXERCISE

Find the interest on the following sums:

1. \$250; 6 %, 3 yr.
2. \$900; 5 %, 8 mo.
3. \$475; 3 %, 2½ yr.
4. \$860; 4 %, 7 mo.
5. \$800; 3½%, 6 mo.
6. \$880; 5 %, 9 mo.
7. \$950; 6 %, 1½ yr.
8. \$750; 6 %, 2⅙ yr.
9. \$1400; 6 %, 3 yr. 2 mo.
10. \$2000; 2½%, 2 yr. 4 mo.
11. \$840 ; 3½%, 3 yr. 6 mo.
12. \$225 ; 4 %, 1 yr. 9 mo.
13. \$650 ; 6 %, 1 yr. 1 mo.
14. \$1200; 6 %, 2 yr. 3 mo.
15. \$1450; 5 %, 1 yr. 8 mo.
16. \$1600; 2½%, 2 yr. 8 mo.

17. What is the interest on \$1280 for 2 yr. 4 mo. 16 da. @ 4%?

18. A man borrowed \$2400 for 1 yr. 6 mo. 20 da. at 6%. What is the interest; the amount?

19. What will be the interest on \$1500 loaned for 1 yr. 5 mo. 10 da. at 6%? What will be the amount?

Find the interest if:

20. \$1950 is loaned at 4½% for 10 mo. 12 da.
21. \$1600 is loaned at 3½% for 2 mo. 12 da.
22. \$160.25 is loaned at 4 % for 2 mo. 20 da.
23. \$825.60 is loaned at 5½% for 6 mo. 15 da.
24. \$3000 is loaned at 6 % for 7 mo. 12 da.

Find the amounts:

25. \$1250; 6 %, 2 yr. 2 mo.
26. \$1620; 3 %, 4 mo. 15 da.
27. \$3600; 4 %, 2 yr. 6 mo.
28. \$2000; 5½%, 9 mo. 12 da.
29. \$1400; 4½%, 1 yr. 10 mo.
30. \$2100; 4 %, 7 mo. 15 da.

31. On May 1, 1917, I loaned \$350 at the rate of 5½%. What amount of principal and interest will be due me on Jan. 1, 1919?

32. \$2470 is borrowed for a period of 240 da. at 4%. What interest is due at the expiration of this time?

33. Mr. Anderson borrowed \$750 May 15, 1915, and agreed to pay it June 3, 1916, with interest at 6%. What was the total amount of his debt when the time was up?

34. What is the amount of \$630 from July 29, 1917 to January 5, 1919 at 4%?

35. What is the interest on \$4000 at 4% from Jan. 1, 1916, to Jan. 18, 1918?

SHORT METHODS OF FINDING INTEREST

(*a*) **The Six Per Cent Method.** This method, also called the **Bankers' 60-Day Method**, is convenient in cases where money is loaned for short terms, such as 60, 90, 120 days, etc.

This method is based on the following:

For 1 yr.	at 6%, the interest on $1 is	$.06
For 2 mo. (60 da.)	at 6%, the interest on $1 is	.01
For 3 mo. (90 da.)	at 6%, the interest on $1 is	.015
For 1 mo. (30 da.)	at 6%, the interest on $1 is	.005
For 6 da.	at 6%, the interest on $1 is	.001

Find the interest on $580 for 3 mo. 21 da. at 6%:

Interest for 2 mo. is	.01	of	$580 =	$5.80
Interest for 1 mo. is	$\frac{1}{2}$	of	$5.80 =	2.90
Interest for 15 da. is	$\frac{1}{2}$	of	$2.90 =	1.45
Interest for 6 da. is	.001	of	$580 =	.58
Interest for 3 mo. 21 da.				= $10.73

ORAL EXERCISE

Tell quickly the interest on $100 *at* 6% *for:*

1. 15 da.
2. 75 da.
3. 120 da.
4. 5 mo.
5. 90 da.
6. 45 da.
7. 1 mo. 6 da.
8. 2 mo. 12 da.
9. What is the interest on $25 for 2 yr. 2 mo. at 6%?
10. What is the interest on $125 for 6 mo. 6 da. at 6%?

WRITTEN EXERCISE

Find the interest on:

1. $642 for 75 da.
2. $1250 for 90 da.
3. $1720 for 120 da.
4. $1480 for 1 mo. 15 da.
5. $2400 for 2 mo. 10 da.
6. $5400 for 3 mo. 20 da.

7. $1550 for 2 mo. 15 da. 9. $7200 for 2 mo. 15 da.
8. $4000 for 1 mo. 24 da. 10. $8600 for 3 mo. 10 da.

A man borrowed $840 on Dec. 5, 1917, which he repaid on April 14, 1918, at 6%. What was the amount that he paid?

Method: Int. on $840 = $8.40 for 60 da. ($840 × .01)

Dec. = 26 da. to run,			
Jan. = 31 da. in all,	Therefore:	Int. for 120 da. =	$16.80
Feb. = 28 da. in all,		Int. for 10 da. =	1.40
Mar. = 31 da. in all,		Interest =	$18.20
Apr. = 14 da. to run.		Principal =	840.
130 da. = exact time.		Amount =	$858.20

(It is customary, for short periods, to find exact number of days.)

Find the amount of:

11. $1260, from Mar. 5 to June 3, at 6%.
12. $ 720, from June 14 to Oct. 12, at 6%.
13. $1450, from Sept. 3 to Jan. 1, at 6%.
14. $2200, from Apr. 29 to July 13, at 6%.
15. $3275, from May 24 to Nov. 30, at 6%.

(*b*) **The Six Per Cent Method at Other Rates.** When the interest has been found upon a principal at 6%, the interest can be computed quickly at any other rate.

To get 2 %: *Take* $\frac{1}{3}$ *of the interest at* 6%;
To get 3 %: *Take* $\frac{1}{2}$ *of the interest at* 6%;
To get 4 %: *Take* $\frac{2}{3}$ *of the interest at* 6%;
To get 5 %: *Subtract* $\frac{1}{6}$ *from the int. at* 6%;
To get 7 %: *Add* $\frac{1}{6}$ *to the interest at* 6%;
To get $4\frac{1}{2}$%: *Subtract* $\frac{1}{4}$ *from the int. at* 6%;
To get $7\frac{1}{2}$%: *Add* $\frac{1}{4}$ *to the interest at* 6%.

WRITTEN EXERCISE

Compute the interest on:

1. \$ 420, for 4 mo. 15 da., at 5 %.
2. \$ 540, for 8 mo. 10 da., at 4 %.
3. \$ 860, for 3 mo. 20 da., at 3 %.
4. \$1325, for 75 da., at 5 %.
5. \$1470, for 3 mo. 6 da., at 3 %.
6. \$2500, for 8 mo. 15 da., at $4\frac{1}{2}$%.
7. \$2200, for 2 mo. 20 da., at $5\frac{1}{2}$%.
8. \$1450, for 4 mo. 5 da., at 2 %.
9. \$ 375, for 90 da., at $7\frac{1}{2}$%.
10. \$3000, for 7 mo. 20 da., at 4 %.
11. \$3470, for 6 mo. 6 da., at 5 %.
12. \$3250, for 2 mo. 29 da., at 4 %.

13. A man borrowed \$1800 on Mar. 5 and repaid the loan on July 3. If the rate was 5%, what was the interest due? What was the total amount paid on July 3?

14. A business firm borrowed \$3000 from its bank on Jan. 1, at 6%, and \$2100 on Mar. 15, at 5%. The entire indebtedness was paid on Nov. 5. What was paid?

(*c*) **Optional Variation of the Six Per Cent Method: To Find the Interest by Multiples of \$1 as Principal.** In this method, the interest is found, for the entire time, on \$1; then, on the given principal.

Find the interest on \$700 for 1 yr. 3 mo. 24 da. at 6%.

Interest on \$1 for 1 yr. $= 1 \times \$.06 = \$.06$
Interest on \$1 for 3 mo. $= 3 \times .005 = .015$
Interest on \$1 for 24 da. $= 24 \times .000\frac{1}{6} = .004$
Interest on \$1 for 1 yr. 3 mo. 24 da. $= \$.079$

Interest on \$700 for 1 yr. 3 mo. 24 da. will be
$\$700 \times \$.079 = \$55.30$.

ORAL EXERCISE

State the interest on \$1 *at* 6% *for:*

1. 7 mo.	4. 9 mo. 6 da.	7. 1 yr. 3 mo.
2. 11 mo.	5. 2 mo. 12 da.	8. 1 yr. 24 da.
3. 5 mo. 6 da.	6. 3 mo. 18 da.	9. 1 yr. 1 mo. 6 da.

WRITTEN EXERCISE

Find the interest on:

1. \$ 820, for 2 yr. 6 mo. 24 da. at 6%.
2. \$1560, for 1 yr. 2 mo. 18 da. at 6%.
3. \$4600, for 2 yr. 3 mo. 6 da. at 6%.
4. \$3600, for 2 yr. 8 mo. 3 da. at 3%.
5. \$1240, for 3 yr. 8 mo. 24 da. at 5%.
6. \$2240, for 1 yr. 10 mo. 12 da. at 6%.
7. \$2500, for 1 yr. 7 mo. 20 da. at 4%.
8. \$1820, for 1 yr. 4 mo. 18 da. at 6%.
9. \$960, from May 3, 1915 to Jan. 4, 1917 at 6%.
10. \$1480, from Oct. 20, 1914 to Feb. 2, 1916 at 6%.
11. \$2260, from July 8, 1913 to Dec. 15, 1914 at 4%.
12. \$3200, from Apr. 24, 1918 to Sept. 2, 1919 at 3%.
13. A man loaned a friend \$1650 for 1 yr. 10 mo. 6 da. at 4%. What was the interest?
14. On Aug. 16, 1915, a bank loaned \$2100 at 6% interest. The principal and interest were paid on June 30, 1917. What was the amount paid?

PROMISSORY NOTES

A Promissory Note is a written agreement to pay a specified sum of money upon demand or on a given date. It is signed by the borrower.

There are two kinds of promissory notes; **time notes** and **demand notes.**

(*a*) **A Time Note** is one that is payable, or due, upon a given date, stated in the note.

350\frac{00}{100}$ ***Albany, N. Y.,*** *Dec. 4,* ***1917.***

Four months ***after date, for value received, I promise to pay to***...*Ely M. Behar*.....***or order,***
Three hundred fifty and $\frac{00}{100}$.....***Dollars with interest at*** *6%.*

.....*George H. Hickey*.....

The above is called a **time note** because it is not **due** until four months after the date.

A promissory note gives several important facts. It tells the amount of the note, that is, the **face of the note** both in figures and in writing; the date when it was written or **drawn;** the rate of interest; the time of payment; the name of the person, company, or corporation who agrees to pay the note; the name of the person, company, or corporation to whom it is payable.

The one to whom the note is payable is the **payee;** the one who signs the note is the **maker** or **drawer.**

The time between the date when the note was drawn and that on which it becomes due is called the **time** of the note; the day on which it becomes due, or **matures,** is called the day or date of **maturity.**

Whenever a note becomes due on a Saturday, a bank half-holiday, or on a legal holiday, it is usually payable on the next business day; but, in some states, Pennsylvania, for instance, such a note must be paid on the preceding business day.

Provision must be made to meet a note when due. A business man soon loses his credit if he is careless about honoring his notes. Credit lost is practically impossible to regain.

(*b*) A Demand Note is one that is due upon any day that the holder of it chooses to present it for payment.

> *840\frac{00}{100}$* ***Philadelphia, Pa., Aug. 2, 1918.***
>
> ***On demand, for value received, I promise to pay to*** *David E. Telfer* ***or order,*** *Eight hundred forty* $\frac{00}{100}$ ***Dollars with interest at 6%.***
>
> *Joseph Maloney*

Both these notes are **interest-bearing notes.** If a note does not state " with interest," it is called a **non-interest-bearing note.** Interest-bearing notes carry interest from the day upon which they are drawn to that upon which they fall due. If the rate be not given, it is understood that it is the **legal rate** of the state in which the note is made.

In New York and in Pennsylvania, the legal rate is 6%.

Formerly, three days beyond the date of maturity were allowed the drawer of a note, in which to meet payment of the note. Those days were called **days of grace.** Interest-bearing notes bore interest for these three days as well as for the regular time of the note.

In most of the states of the United States, days of grace are no longer allowed; in some, they are still allowed; often, these days are allowed in the case of a demand note. Therefore, it is always wise to find out the law in respect to any state in which a note is payable.

ORAL EXERCISE

1. Read the note on page 142.

What is the face? Who is the payee? Who is the maker? When is the note due? What is meant by the expression "date of maturity"?

2. Read the note on p. 143.

How does this note differ from the first?

WRITTEN EXERCISE

1. Write a promissory note in which John Barrington agrees to pay Sarah L. Grosset $250, five months after date, with interest at 6%.

2. James Maloney pays the demand note (on page 143) on Feb. 25, 1919. Write out a check in payment of the amount.

3. A man pays a demand note for $720 with interest at 5%, 20 days after it was made. How much does he pay?

4. Make out a non-interest bearing note for $1250 in which Charles L. Harris is the maker and Sidney Jameson the payee. The note is payable on demand.

Find the amount paid on each of these notes:

	MAKER	PAYEE	FACE	RATE	TIME
5.	Harold Buell	John H. Vincent	$280	6 %	3 mo.
6.	Arnold Dean	Rudolph Tossi	$550	5 %	8 mo.
7.	Harry Whitney	Gladys Buckridge	$375	4 %	4 mo.
8.	Isabel Lucy	H. A. Turner	$930	4½%	1 yr.

9. Make out and date the note in Ex. 5 above.

10. Make out and date the note in Ex. 8 above.

Indorsement of Notes. The payee of a note may not wish to wait for his money until the note matures and he may sell it to another person, company, corporation, or, what is most likely, to a bank. To do this, he must **indorse** it by writing his name across the back, in precisely the same

way that he would indorse a check. This indorsement makes him responsible to the new payee, if the drawer of the note should fail to pay it when due.

When a note is written " to the order of " or to someone " or order," that note is said to be **negotiable**, and the payee can order it paid to some third party. When a note is made payable to a specified party, and the expressions " or order," " to the order of " are omitted, that note is **non-negotiable.** It is not to be sold. It is payable only to the payee named in the face of the note.

There are several forms of indorsement for notes.

(*a*) If Ely M. Behar wishes to transfer George H. Hickey's note to Donald F. Bergh, he may write his name on the back; this makes the note payable to anyone who may hold it.

This is called an **indorsement in blank.**

Ely M. Behar

(*b*) If he indorses it to the order of Donald F. Bergh, it becomes payable only to Mr. Bergh or his order.

This is called an **indorsement in full.**

Pay to the order of
Donald F. Bergh

Ely M. Behar

(*c*) If he indorses it to Donald F. Bergh, he limits the payment of it to Mr. Bergh, and the note becomes non-negotiable beyond Mr. Bergh.

This is called a **restrictive indorsement.**

Pay to Donald F. Bergh

Ely M. Behar

(*d*) If he wishes to save himself all future responsibility for the payment of the note, he indorses it " without recourse."

This is called an **indorsement without recourse.**

Without recourse

Ely M. Behar

ORAL EXERCISE

1. Ely M. Behar sold George H. Hickey's note to R. E. O'Hara and indorsed it in blank. If Mr. Hickey failed to pay the note, who was responsible for the amount?

2. Isabel Lucy gave her note to H. A. Turner. Mr. Turner sold it to Graham E. Rale. How can Mr. Turner indorse it so that he will not be responsible, if Miss Lucy fails to pay?

3. How should he indorse it if he does not wish it to be transferred again by Graham E. Rale?

WRITTEN EXERCISE

1. Joseph Meighan borrows \$950 at 4% for 3 mo. from R. A. Keener and gives his note. Mr. Keener sells the note to Clayton G. Durfee. Make out and indorse the note. What is the amount due at maturity?

2. Make out a note for \$1240 as in Ex. 1. Indorse it so that Mr. Keener will not be responsible if the maker fails to pay. Write out a check in full payment.

3. On Aug. 10, 1917, A. B. See gives his note for \$785 to Charles Judd, interest at 6%, for 5 mo. Indorse it so that it is payable to the order of Clinton Reed, who in turn sells it to Mary L. Fripp. What is the amount due at maturity?

Find the dates of maturity and the amounts due on the following notes:

	FACE	DATE	RATE	TIME
4.	\$1320	Nov. 28, 1914	5 %	4 mo.
5.	\$ 485	Jan. 5, 1913	4 %	90 da.
6.	\$ 700	Oct. 30, 1915	3½%	60 da.
7.	\$ 960	Dec. 13, 1914	6 %	7 mo.
8.	\$1820	Apr. 16, 1917	5½%	1 yr.
9.	\$ 425	May 3, 1915	7 %	90 da.

IV. BORROWING AND LENDING MONEY: BANK DISCOUNT

Bank Discount. Business men often need extra money to use for short periods of time, two or three months, to finance their business: they may need to lay in new stock; to buy new machinery; to build additions to their plants; to pay a larger force of employees. This extra capital is obtained generally from the commercial banks.

Banks are willing to lend money to business concerns on promissory notes, provided always that those concerns are well-rated, known to be honorable in their business dealings; or, if not well-known, indorsed by those who are. For the credit that the banks grant, they charge interest. This interest is always deducted from the face or amount of the note, in advance; it is always reckoned in exact days, from the time that the money is lent until the day that the note falls due. This interest, charged thus in advance by the bank for the use of money, is called **bank discount.** The amount of money turned over by the bank, the difference between the face of the note and the bank discount, is called the **proceeds.** The rate charged by the bank is usually the legal rate of the state in which the bank is situated. In times of stress, especially in times when there is much demand for money, and when business conditions may be bad, the banks will charge a larger rate than at times when they have much money on hand, or when business conditions are good.

Terms of Discount. The **term of a note** is the time between that when the note was drawn and the date of maturity. The **term of discount** is the time between that

when the bank accepted the note and the time when the note is due.

As a rule, notes given to banks are payable in short periods of time: 30 days, 60 days, 90 days; 1 month, 2 months, 3 months; very rarely, and only from business men of the highest standing, are notes accepted by banks for more then 4 months.

If Henry Folsom should borrow the $800 from his bank, due 2 months after Dec. 31, 1917, the date of maturity would be Feb. 28, 1918; but, if it should be due 2 months after Dec. 31, 1919, the date of maturity would be Feb. 29, 1920.

If Henry Folsom's note should be due 60 days after Dec. 31, 1917, the date of maturity would be Mar. 1, 1918; but if it should be due 60 days after Dec. 31, 1919, the date of maturity would be Feb. 29, 1920.

Therefore:

(*a*) *A note, payable one or more months after the date of the note, is due upon the same relative day of the month.*

(*b*) *A note, payable a designated number of days after the date of the note, is due upon the expiration of the exact number of days.*

Some banks charge the discount upon the exact number of days left for the note to run, after the day of the discount; others reckon the time including both the day when the discount was granted and the day that the note matures.

(*c*) *Bank discount is reckoned upon the exact number of days from the day of discount to the date of maturity.*

A note drawn May 8, 1917, for 2 mo., is due July 8, but the discount is computed for 61 da.

A note drawn Feb. 8, 1917, for 2 mo., is due Apr. 8, 1917, and the discount is computed for 59 da.

A note drawn Feb. 8, 1920, for 2 mo., is due Apr. 8, 1920, and the discount is computed upon 60 da.

Borrowing from a Bank. Because of the enormous sums of money deposited in them for safe keeping or against checking, banks are able to discount the notes offered by their customers to them. They gain profits also by investing their surplus in well-paying real estate, in stocks, and in bonds; they gain greatly by the discounting of notes, because they always charge a much higher rate of interest than they pay on deposits. They often demand that their customers safe-guard them by having one or more indorsers upon the notes; often, they demand security —real estate, stocks, or bonds. However, whenever the integrity and standing of the borrower are known to them, they require no security except the written promise, or note. This is why it is so vital that a man pay his notes on time. As a matter of fact, in banking circles, *character* stands for more than *property* as a basis for credit.

Henry A. Folsom borrows at bank $800 on his note.

$800\frac{00}{100}$ **Philadelphia,** *Nov. 9,* **1917**

Three months **after date, I promise to pay to the order of** *The First National Bank*

Eight hundred $\frac{00}{100}$ **Dollars**

Value Received. *Henry A. Folsom*

If Mr. Folsom is well known to the bank officials, they will accept this note; if his financial standing is not very strong, he may be asked to get some one to indorse the note for him, that is, become responsible for its payment in case he fails to pay. In this case, Mr. Folsom will make the note payable to the **indorser.** This person **indorses** the note on the back, thereby promising to pay the money to the bank, if Mr. Folsom fails to do so on time. If Mr. Folsom has good securities available, he may deposit these with the bank instead of getting an indorser.

To Discount a Note. Mr. Folsom, having turned in his note to the bank, will receive his money, *after* the bank has deducted the discount at the legal rate, or at the rate agreed upon.

(*d*) *The bank discount is the interest charged in advance upon notes by banks.*

(*e*) *The proceeds of this note, the amount advanced, equals the difference between the face of the note and the bank discount.*

If the bank charged Mr. Folsom 6% discount, what were the proceeds of the note on the preceding page?

3 mo. from Nov. 9, 1917	= Feb. 9, 1918.
Exact no. of da.	= 92
Discount on $800	= $12.27
Proceeds of $800	= $787.73

ORAL EXERCISE

Find the bank discount on the following notes at 6%:

1.	$900; 90 da.	9.	$640; 120 da.	17.	$ 860; 60 da.
2.	$280; 90 da.	10.	$720; 60 da.	18.	$1050; 30 da.
3.	$880; 90 da.	11.	$800; 90 da.	19.	$2000; 90 da.
4.	$950; 60 da.	12.	$900; 30 da.	20.	$4200; 30 da.
5.	$450; 60 da.	13.	$1100; 30 da.	21.	$1800; 30 da.
6.	$720; 120 da.	14.	$1500; 60 da.	22.	$4500; 60 da.
7.	$2000; 60 da.	15.	$2400; 90 da.	23.	$6500; 120 da.
8.	$1400; 30 da.	16.	$3200; 120 da.	24.	$2000; 120 da.

WRITTEN EXERCISE

1. A note for $1800 due in 3 mo. was discounted at a bank at 6%. What were the proceeds?

2. What are the proceeds of a note for $750 due in 120 da. discounted at a bank at 6%?

3. A note for $560 was discounted at the bank at 6%. If the note was drawn Jan. 1, 1918 for 3 mo., what were the proceeds?

4. What is the bank discount on $750 for 60 da. at 7%?

Notes Discounted After Date of Making. All notes are not discounted on the day that they are drawn. A note may be discounted at any time between the time of making and the date of maturity.

On March 1, Robert Duncan, a printer, gives his note for $900, due in 3 mo., to the Rotary Press Co. in part payment for a new press.

900\frac{00}{100}$ ***Philadelphia,*** *Mar. 1,* ***1920.***

Three months ***after date, I promise to pay***

to *The Rotary Press Company* ***, or order,***

Nine hundred $\frac{00}{100}$ ***Dollars,***

at the *Merchant Trust Co., Philadelphia.*

Value Received.

Robert Duncan.

No. *336.*

The Rotary Press Co. keeps the note in its safe until March 23, when it needs money. On this date, the firm discounts the note at its bank at 6%.

What was the discount period? What were the proceeds?

3 mo. from Mar. 1 is June 1, the date of maturity.
From Mar. 23 to June 1 = 70 days = discount period.
Face of the note = $900.
Discount on the note for 70 days at 6% = 10.50
Proceeds = $889.50

ORAL EXERCISE

In the Written Exercise below, tell quickly the date of maturity and the term of bank discount on each of the notes:

Example: The date of maturity is Jan. 1, 1921. The term of discount is from Nov. 21, 1920, to Jan 1, 1921.

WRITTEN EXERCISE

Find the bank discount and the proceeds of these notes:

	FACE	DATE	TIME	DISCOUNTED ON	RATE
1.	$ 500	Nov. 1, 1920	2 mo.	Nov. 21, 1920	6%
2.	$ 720	Jan. 20, 1918	1 mo.	Jan. 31, 1918	6%
3.	$1200	Dec. 4, 1916	3 mo.	Jan. 24, 1917	5%
4.	$2200	Mar. 10, 1920	1 mo.	Mar. 21, 1920	6%
5.	$ 920	June 25, 1918	2 mo.	July 26, 1918	6%
6.	$ 340	Oct. 2, 1918	3 mo.	Nov. 23, 1918	5%
7.	$ 750	Apr. 15, 1919	1 mo.	Apr. 25, 1919	5%
8.	$1000	Mar. 10, 1921	2 mo.	Mar. 31, 1921	6%
9.	$ 840	July 20, 1918	3 mo.	Sept. 20, 1918	6%
10.	$1800	May 15, 1920	4 mo.	July 27, 1920	6%
11.	$1200	Oct. 6, 1918	4 mo.	Nov. 8, 1918	6%
12.	$2500	Mar. 3, 1914	3 mo.	Apr. 1, 1914	7%

13. Make out a 60-day note for $1400 dated to-day, payable to Harrison Forbes' order at a bank in your neighborhood. Discount the note to-day at 6%.

14. A man gave his 60-day note for $2000, dated Jan. 3, 1917, to a bank. The note was discounted Feb. 12, 1917 at 5%. Make out this note, and compute the proceeds.

15. Make out a note, drawn for $2000, for 60 da., dated July 3, 1917. If it was discounted one mo. after it was made, what were the proceeds?

The Federal Banking Company discounted the following notes on July 8, 1917, charging 5% discount.

What was the date of maturity, the term of discount, and the proceeds of each note?

16. A four-months' note for $450, dated June 15, 1917.
17. A note for $95, dated May 4, 1917, time 100 da.
18. A six-months' note, dated Mar. 10, 1917, for $1500.

To Discount Interest-bearing Notes. A person who is made the payee of an interest-bearing note may desire to secure money at once and to discount the note. Bank discount is figured on the *value* of a note at maturity and this in an interest-bearing note is not the same as the face of the note.

Suppose Henry D. Farrell, the payee of the following note, needs money for his payroll on June 1, 1917 and has the note discounted by a bank on that date. What are the proceeds?

> *750\frac{00}{100}$* ***Buffalo, N. Y., June 1, 1917.***
>
> *Three months* ***after date, I promise to pay***
> *to Henry D. Farrell* ***, or order,***
> *Seven hundred fifty $\frac{00}{100}$* ***Dollars.***
>
> ***Value Received, with interest at 5 %.***
>
> *Cornelius H. Brown.*

Interest for 3 mo. on $750 at 5%	=$ 9.38
Face of the note	= 750.
Value of the note at maturity	=$759.38
Less discount for 92 da. at 6% on $759.38	= 11.50
Proceeds	=$747.88

Henry D. Farrell, to meet his payroll, discounts the note on June 23. What are the proceeds?

Interest for 3 mo. on \$750 at 5%	=\$ 9.38
Face of the note	= 750.
Value of the note at maturity	=\$759.38
Less discount for 70 da. (June 23 to Sept 1) at 6% on \$759.38	= 8.86
Proceeds	=\$750.52

(Note especially that the bank discount is figured on the exact number of days, even though the interest on the note is figured for 3 mo.)

ORAL EXERCISE

1. On June 12, 1917, Henry Davenport gave his 60-da., 5% note for \$600 to Lloyd & Parker. Lloyd & Parker discounted the note on June 12, at 6%. *State:*

(*a*) *When this note was due;*
(*b*) *For how many days the interest was reckoned;*
(*c*) *What the amount of the interest was;*
(*d*) *What the term of discount was;*
(*e*) *What the bank discount was;*
(*f*) *What the proceeds were.*

2. L. & P. discounted Davenport's note on June 22. *Make the statements called for under Example* 1.

State the interest on the following notes and tell the amounts upon which the bank discounts would be based:

	FACE	TIME	RATE		FACE	TIME	RATE
3.	\$ 800	90 da.	6%	8.	\$1800	120 da.	6%
4.	\$1200	60 da.	4%	9.	\$2800	90 da.	5%
5.	\$2000	30 da.	5%	10.	\$3000	30 da.	6%
6.	\$ 840	90 da.	6%	11.	\$3600	60 da.	6%
7.	\$ 320	60 da.	3%	12.	\$4200	120 da.	3%

WRITTEN EXERCISE

1. A 3-mo. note for $1020, interest at 4%, is discounted on the date of making at 6%. Tell the proceeds.

2. A note for $7500 payable in 1 yr. with interest at $4\frac{1}{2}\%$ was discounted at date of making at 6%. What are the proceeds?

The following interest-bearing notes were discounted on the date of making at 6%. *Find the proceeds:*

	FACE	TIME	RATE OF INTEREST		FACE	TIME	RATE OF INTEREST
3.	$ 320	90 da.	2%	**6.**	$930	30 da.	5%
4.	$ 820	4 mo.	4%	**7.**	$450	3 mo.	4%
5.	$1200	2 mo.	5%	**8.**	$225	1 yr.	3%

9. A 60-day note for $150 with interest at 6% is discounted 24 da. after date at 6%. What are the proceeds?

10. A dealer bought goods for $1350, giving his note June 10 for 90 da. with interest at 3%. The note is discounted June 30 at 6%. What are the proceeds?

Compute the bank discount and the proceeds of these notes:

	FACE	DATE	TIME	RATE OF INTEREST	DATE OF DISCOUNT	RATE OF DISCOUNT
11.	$ 800	Mar. 5	60 da.	6%	Mar. 25	6%
12.	$ 420	Aug. 20	4 mo.	6%	Sept. 1	6%
13.	$1600	Apr. 12	30 da.	5%	Apr. 12	6%
14.	$2000	Sept. 15	90 da.	4%	Nov. 4	5%
15.	$2700	May 10	40 da.	6%	May 20	6%
16.	$ 810	Oct. 4	2 mo.	4%	Oct. 20	6%
17.	$1920	June 15	75 da.	6%	June 30	6%
18.	$3200	Mar. 25	4 mo.	6%	Apr. 16	5%
19.	$4100	July 2	5 mo.	5%	July 10	6%
20.	$2600	Apr. 30	6 mo.	6%	July 30	6%

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	How many days between:		*Solve:*		
1.	Oct. 5, Dec. 31?	Mar. 5, June 30?	3×10	$\frac{2}{3}$ of 96	7×13
2.	Apr. 14, Aug. 27?	May 19, Aug. 3?	3.8×10	$\frac{4}{5}$ of 105	4×13
3.	Jan. 2, Feb. 22?	Aug. 21, Dec. 5?	$.847\times10$	$\frac{2}{3}$ of 75	$81\div3$
4.	Nov. 19, Jan. 3?	Oct. 28, Jan. 2?	6.37×10	$\frac{7}{8}$ of 240	$98\div18$
5.	June 3, Sept. 23?	July 3, Oct. 3?	19.8×10	$\frac{3}{4}$ of 380	$54\div18$

	Find the selling price:				*Tell results:*		
	COST	GAIN	COST	LOSS			
6.	\$40	20 %	\$12	$33\frac{1}{3}$%	$.7\div10$	$4)\underline{84}$	24×2.50
7.	\$56	$12\frac{1}{2}$%	\$80	$37\frac{1}{2}$%	$6.3\div10$	$5)\underline{95}$	$42\times1.14\frac{2}{7}$
8.	\$90	$66\frac{2}{3}$%	\$400	75 %	$.85\div10$	$6)\underline{84}$	$32\times2.87\frac{1}{2}$
9.	\$600	5 %	\$500	40 %	$17.8\div10$	$7)\underline{133}$	$73\times1.11\frac{1}{9}$
10.	\$120	25 %	\$4000	10 %	$5.89\div10$	$8)\underline{128}$	$36\times2.33\frac{1}{3}$
11.	\$800	10 %	\$4800	$66\frac{2}{3}$%	$3.19\div10$	$9)\underline{135}$	$\frac{1}{6}\times78$
12.	\$5500	20 %	\$3600	50 %	$68.5\div10$	$8)\underline{104}$	$\frac{3}{7}\times56$
13.	\$7200	$8\frac{1}{3}$%	\$2400	$16\frac{2}{3}$%	$276\div10$	$7)\underline{112}$	$\frac{2}{3}\times93$

14.	$3.4+5.6$	$12.7\div.9$	$.28-.09$	$.21\times.8$	$.12\times20$
15.	$2.3+18.32$	$.42\div.06$	$4.1-1.3$	$.43\times4.$	$.31\times30$
16.	$.86+.023$	$1.5\div.03$	$5.2-.03$	$5.6\times.2$	1.2×40
17.	$.14+.011$	$2.4\div.024$	$.24-.024$	$.084\times10$	3.3×30
18.	$.86+.023$	$1.25\div.005$	$.046-.038$	7.43×10	2.2×50

	Find the interest on \$200 *for* 2 *yr. at:*		*Tell results:*		
19.	6 %	7 %	$\frac{1}{8}$%	85×100	$80\times.62\frac{1}{2}$
20.	3 %	4 %	$\frac{1}{2}$%	2.7×100	$49\times.14\frac{2}{7}$
21.	2 %	9 %	$11\frac{1}{9}$%	4.6×100	$88\times.12\frac{1}{2}$
22.	5 %	8 %	$33\frac{1}{3}$%	$.39\times100$	$32\times.37\frac{1}{2}$
23.	$2\frac{1}{2}$%	$4\frac{1}{2}$%	$87\frac{1}{2}$%	$.398\times100$	$24\times.66\frac{2}{3}$
24.	$3\frac{1}{2}$%	$1\frac{1}{2}$%	25 %	4.09×100	$60\times.12\frac{1}{2}$
25.	$8\frac{1}{2}$%	10 %	50 %	9.54×100	$27\times.11\frac{1}{9}$

GENERAL WRITTEN PROBLEMS

1. A farmer raises 27.5 acres of sugar beets. They average 9.8 T. to the acre. If he sells his beets at \$4.40 a T., how much money should he receive?

2. If I lend \$2150 for 1 yr. 3 mo. 20 da. at 6%, what amount shall I receive at expiration of time?

3. The floor of a room is 20′ 6″ long and 14′ 3″ wide. What is the cost of laying a parquet floor at 24¢ a sq. ft., allowing 10 sq. ft. for projections on the floor?

4. Tell the bank discount and proceeds on a 90-da. note for \$2800 discounted at 5% on the day it was made.

5. At a clearance sale, ermine scarfs valued at \$155 are reduced to \$126.30, and muffs valued at \$125 are reduced to \$96.25. What is the average per cent of reduction on these two articles?

6. A salesman sold $17\frac{3}{4}$ yd. of silk at 89¢ a yd. What is the amount of his sales check?

7. A quart of varnish will cover a space of 150 sq. ft. How much will it cost at \$2.80 a gal. to varnish two floors whose dimensions are 18′ × 15′ and 15′ × 12′?

8. A dealer bought 300 T. of ice for \$750. He sold the ice at the rate of 25¢ per cwt. What per cent did he gain?

9. What are discount and proceeds of a 60-day note for \$775 discounted 12 da. after date at 5%?

10. What is the amount of these items: $9\frac{1}{2}$ lb. cheese @ 15¢ a lb.; 80 oranges at 24¢ a doz.; $7\frac{3}{4}$ yd. broadcloth at \$1.50 a yd.; $6\frac{1}{2}$ bu. crabapples @ 14¢ per pk.; 7 doz. crackers at \$2.50 per gross?

11. A man purchased a house for \$5000. The first year he paid for repairs \$45, for taxes \$75, and for insurance \$10. If the house was rented for \$40 a mo., what per cent did he gain that year on his original investment?

12. How many cu. yd. of earth will have to be removed in digging a cellar 18′ wide, 55′ long, and 6 ft. deep? What will the cost be at 60¢ a load of 1 cu. yd.?

13. A note for $2050 dated Jan. 14, 1918 for 4 mo. was discounted Mar. 17, 1918 at 6%. What were the proceeds?

14. A stock clerk earns $14 a week. He pays $6.50 for board, $.70 for carfare, $1.25 for amusement, $.88 for laundry and $3.17 for other expenses. How many weeks will it take him to save $200?

15. If a dealer buys electric lamps at a discount of 30% and sells them at an advance of 30% on the list price, what rate of profit does he make?

16. A loan of $1260 dated Jan. 2, 1917, was canceled on Dec. 21, 1917 with interest at 5%. What was the amount paid to cancel the debt?

17. Mrs. George H. Hickey has an account with the Fidelity Trust Co. She orders from general store 2 pr. gloves @ $2.25, 3½ yd. silk at $.88 and a hat for $7.65. She receives a discount of 8%. Write out the check for the bill.

18. On Feb. 1, a man's balance was $243.37. Feb. 5, he deposited $181.50, Feb. 10, $60.83 and a check for $27.75, Feb. 13, a check for $75, Feb. 24, $193; Feb. 28, he drew out $370. Find his balance on Mar. 1.

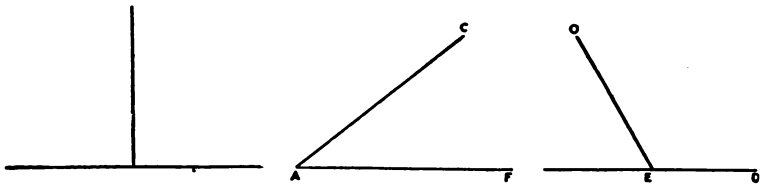
19. Candler Motor Company sells Raymond Hancock an automobile for $1950 less 15% discount, and received his check on the Seaboard National Bank. Write the check.

20. The discount on a note for $500 having 96 days to run is $8. What is the rate of discount?

21. In payment for 300 bbl. of apples at $3.30 a bbl. a dealer wishes to give a 60-da. note, the proceeds of which, when the note is discounted at 6%, will pay for the goods. What is the face of the note?

V. MEASUREMENT

Angles. When two straight lines meet in a point, they form an **angle.**



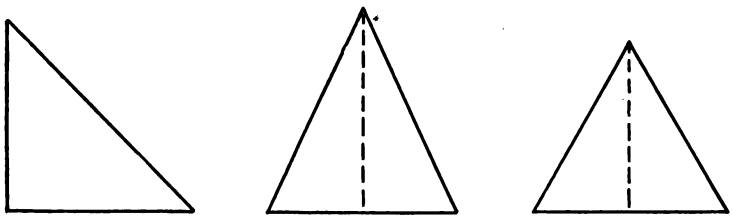
If one straight line meets another at some point within the second, two angles are formed. If these two lines meet in such a way as to form two *equal* angles, the lines are said to be *perpendicular* to each other, and the angles formed are called **right angles.**

If an angle is formed that is *less* than a right angle, it is called an **acute angle.** (*F A C* above.)

If an angle is formed that is *more* than a right angle, it is called an **obtuse angle.** (*D E O* above.)

Triangles. A figure bounded by three straight lines is called a **triangle.**

The bounding line of a triangle is its **perimeter.**



The side upon which the triangle rests is the **base.**

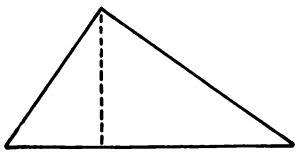
The point of the angle opposite the base is the **apex.**

The perpendicular distance from the base to the apex is the **altitude.** (Note that the altitude is represented in the diagrams by dotted lines.)

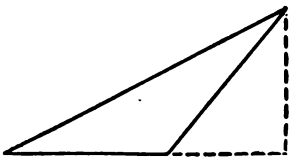
A triangle containing a right angle is called a **right-angled triangle,** or a **right triangle.**

A triangle with two of its sides equal in length is called an **isosceles triangle.**

A triangle with all its sides equal in length is called an **equilateral triangle.**



ACUTE TRIANGLE



OBTUSE TRIANGLE

When a triangle contains only acute angles, it is called an **acute triangle.**

When a triangle contains one obtuse angle, it is called an **obtuse triangle.**

(Note how the altitude is drawn in acute and obtuse triangles.)

WRITTEN EXERCISE

1. What is the perimeter of a triangle whose sides measure 9 in., $4\frac{1}{2}$ in., and $\frac{1}{2}$ ft.?

2. A park has the shape of an equilateral triangle. A fence enclosing the park is 428 yd. long. How long in feet is the park on each side?

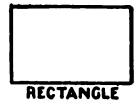
3. Find the perimeter of an isosceles triangle in which the equal sides are 17″ long and the other side $\frac{3}{4}'$.

4. The length of the binding needed for the edge of a triangular kite is $4\frac{1}{2}$ yd. If the sides of the kite are all equal how many inches of binding will be needed for each side?

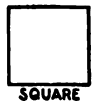
Quadrilaterals. A figure that is bounded by four straight sides is called a **quadrilateral.** This word means " four-sided."

When the opposite sides of a quadrilateral are parallel, the figure is called a **parallelogram.**

When the four angles of a parallelogram are all right angles, the figure is called a **rectangle.**

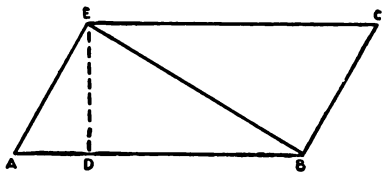


When the four sides of a rectangle are all of the same length, the figure is called a **square.**



The **base** *of a figure is the line on which it seems to stand.*

The **height** *or* **altitude** *of a figure is the distance from the base to the highest point, on a line perpendicular to the base.*

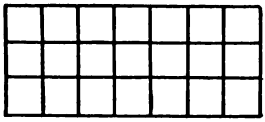


DE, shown by the dotted line, is the altitude of this quadrilateral.

BE, a line joining the opposite corners, is called the **diagonal.**

WRITTEN EXERCISE

1. Draw a quadrilateral, the opposite sides not parallel.
2. Draw a parallelogram; a rectangle; a square.
3. Show upon the figures you have drawn in 1 and 2:
   (*a*) the altitude;
   (*b*) the diagonal.



To find the Area of a Rectangle. In this rectangle, there are 7 squares in each row, and there are 3 rows. There are 21 squares in the rectangle, or 7×3 squares.

The area of a rectangle is equal to the product of the base and altitude.

WRITTEN EXERCISE

1. The perimeter of a square field is 284 yd. 2 ft. Find the length of one side.

2. The top of a table is $3\frac{1}{2}$ yd. long and 24 in. wide. Find the area of a piece of glass needed to cover it.

3. The floor of one room is $16' \times 29'$ while that of another is $17'\ 6'' \times 27'$. Which room has more floor space?

4. A city lot has a street frontage of $18\frac{1}{2}$ ft. and a depth of 108 ft. What is its area?

5. A building lot contains 9650 sq. ft. If this lot is 200 feet deep, what is its frontage?

6. To a scale of $\frac{1}{2}$ in. to every 50 ft., draw a plan of a lot 225 ft. deep and 75 ft. wide.

7. A lot with a frontage of 40 ft. and a depth of 120 ft. was sold at \$70 per front foot. What was the price paid for this lot per sq. ft.?

8. Find the area, in acres, of a field 160 rd. long and 220 rd. wide.

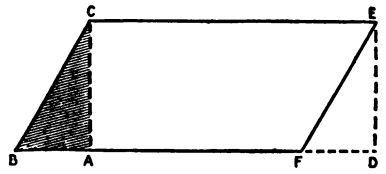
9. A square rug is $8\frac{1}{2}$ ft. on a side. What is the area?

10. A sheet of copper 18 in. long contains 756 sq. in. of metal. How many ft. wide is it?

11. How much will it cost to paint a roof 32 ft. wide and 72 ft. long at $62\frac{1}{2}$¢ a sq. yd.?

12. What is the cost at \$1.25 a sq. yd., of putting down a cement sidewalk $4\frac{1}{2}$ ft. wide and 112 ft. long?

To Find the Area of a Parallelogram. The base of this parallelogram is 10 in. and the altitude is 4 in. What is the area?



If the triangle BAC is cut from one side of the parallelogram and placed at the opposite side, as at FDE, a rectangle will be formed. The area of this rectangle, $ADEC$, will be the same as that of the parallelogram $BFEC$, 10 in. $\times$4 in., or 40 sq. in.

The area of a parallelogram is equal to the product of the base and the altitude:

(or)

The area of a parallelogram is equal to that of a rectangle of the same base and alittude.

WRITTEN EXERCISE

Find the areas of these parallelograms:

	BASE	HEIGHT		BASE	HEIGHT
1.	16 ft. 2 in.;	11 in.	4.	8.5 ft.;	4.1 ft.
2.	14 in.;	.8 in.	5.	6.25 rd.;	15 ft.
3.	16 ft. 3 in.;	2 yd.	6.	7.62 in.;	11.8 in.

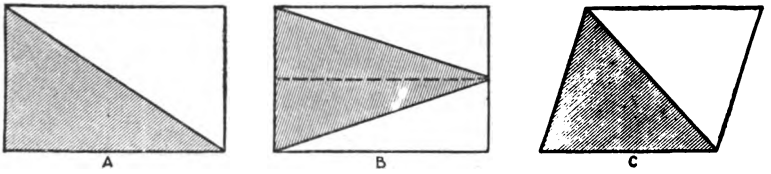
7. What is the area of a parellelogram whose base is 18′ 3″ and altitude 3′ 6″?

8. How many tiles each 3 in. square will be needed to cover the floor of a vestibule 6½ ft. wide and 11 ft. 6 in. long, with no allowance for projections?

9. How many sq. ft. of granolithic will it take to make a walk 2′ 6″ wide by 23′ long?

10. How many yd. of 36″ linoleum will it take to cover a kitchen floor 12′ wide by 13′ 4″ long, including closet 2 yd. deep and 3 yd. wide?

To Find the Area of a Triangle.



(*a*) How would you find the area of rectangle *A*? What part of *A* is the shaded triangle?

(*b*) How would you find the area of rectangle *B*? What part of *B* is the shaded triangle? How would you find the area of the shaded triangle?

(*c*) How would you find the area of parallelogram *C*? How would you find the area of the shaded triangle?

The area of a triangle is equal to half the product of the base and the altitude.

ORAL EXERCISE

1. If *A* is 5 ft. by 2 ft. what is its area? What is the area of each triangle?
2. If *B* is 4 yd. by 10 yd. what is its area? How do you find the area of the triangle?
3. Suppose *C* has a base of 12 ft. and an altitude of 3 ft. What is the area of the triangle?

WRITTEN EXERCISE

Find the area of each of the following triangles:

	BASE	ALTITUDE		BASE	ALTITUDE
1.	22 ft.	5 ft.	6.	2.5 ft.	4 yd.
2.	48 ft.	$14\frac{1}{2}$ ft.	7.	18.7 ft.	6.25 ft.
3.	3 ft. 6 in.	21 ft.	8.	4.87 in.	9.2 in.
4.	7.12 ft.	6.6 ft.	9.	8 ft. 2 in.	17 ft.
5.	4 yd. 2 ft.	1 yd.	10.	5 ft. 3 in.	$2\frac{1}{2}$ yd.

11. The area of a triangle is $302\frac{1}{2}$ sq. ft. The altitude is 11 ft. Find the length of the base.

12. An equilateral triangle has an altitude of 8 ft. 3 in. and a perimeter of $28\frac{1}{2}$ ft. Find the area.

13. Find the area in sq. yd. of a piece of land in triangular form, the base being 90 ft. and the altitude 64 ft.

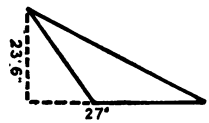
14. A school pennant of triangular shape has a base of 30 in. and an altitude of $8\frac{1}{2}$ in. How much material does it contain?

15. How many acres in a triangular field with a base of 96 rd. and an altitude of 56 rd.?

16. The triangular sail of an ice boat has a base 11 ft. long and an altitude of 14 ft. 3 in. How many sq. ft. of surface does it contain?

17. What will it cost to cement a triangular area with a base of 18 ft. and an altitude of 13 ft. 6 in. at \$1.10 a sq. yd.?

18. How many square feet of linoleum will be required to cover the floor of an irregular hall, shaped like this diagram, and of the dimensions indicated?



19. How many acres are there in a triangular field whose base and altitude are each 30 rd.?

20. A farmer owns a triangular field which is 40 rd. long and 25 rd. wide in the widest part. He sows it to wheat, and harvests a crop that averages 60 bu. per A. How much wheat did he get from this field?

21. A club wishes to decorate its club house with pennants of red, white, and blue. Each pennant is to be 3 ft. long by 1 ft. high. If the bunting bought is 36 in. wide how much must be bought of each color to make 52 each of red and blue and 101 of white?

22. What is the area of a triangle whose base is 25 in. and altitude 55 in.?

To Find the Base and Altitude of a Triangle. Since the area of a triangle is equal to one-half the product of the base and altitude, it follows that it is equal to the product of the base and one-half the altitude, or to the product of the altitude and one-half the base.

Therefore: *If the area and either the base or the altitude be given, the other dimension is found by dividing the area by half of the known dimension.*

ORAL EXERCISE

A triangular piece of ground contains 420 sq. ft. If the length of the plot is 20 ft., what is the depth?

Length = Base Depth = Altitude
$420 \div 20 = 21$ ft., or one-half the altitude.
Therefore, the altitude, or depth, is 21×2 or 42 ft.

1. In cutting triangular naval pennants, a flag maker allows 42 sq. ft. of canvas per pennant. If the base of each is 20 ft., what is the height?
2. In cutting triangular articles, is it economical to plan to make one article?
3. What is the base of a triangle if the area is 240 sq. in. and the height 12 in.?

WRITTEN EXERCISE

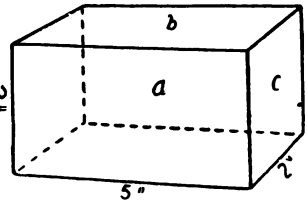
Find the height or the base of the following triangles:

	AREA	HEIGHT	AREA	BASE
1.	460 sq. in.	18 in.	18 A.	40 rd.
2.	590 sq. yd.	7 yd.	341 sq. in.	22 in.
3.	87 sq. ft.	3 ft.	20 sq. yd.	4 ft.
4.	645 sq. ft.	28 ft.	500 sq. ft.	2 yd.
5.	$66\frac{2}{3}$ sq. yd.	16 ft.	$443\frac{1}{3}$ sq. ft.	21 ft.
6.	693 sq. in.	11 ft.	10 A.	25 rd.

Surfaces of Rectangular Solids. A solid differs from a surface because it has three dimensions—*length, breadth,* and *thickness;* the surface has only length and breadth.

A **rectangular solid** is one having six rectangular faces or surfaces.

The **surface** of a rectangular solid includes the total surface of the six rectangles that bound it. The rectangles on the opposite sides of the solid are equal.



This rectangular solid is $5'' \times 3'' \times 2''$. What is the area of the entire surface?

There are 6 rectangular surfaces: 2 like (a); 2 like (b); 2 like (c).

Area of $(a) = 5'' \times 3'' = 15$ sq. in. $\times 2 = 30$ sq. in.
Area of $(b) = 5'' \times 2'' = 10$ sq. in. $\times 2 = 20$ sq. in.
Area of $(c) = 2'' \times 3'' = 6$ sq. in. $\times 2 = 12$ sq. in.
31 sq. in. $\times 2 = 64$ sq. in.

Note that above solution shows proof of correctness of work, and allows of analysis of the solution.

The short method of solving is to get the sum of the areas of the front, top, and side surfaces $(a+b+c)$(31 sq. in.) and multiply by 2.

WRITTEN EXERCISE

1. A block of granite is 3′ by 7′ by 4′. Find the entire surface of the block.

2. A trunk is $24'' \times 36'' \times 20''$. How many sq. ft. of canvas will be needed to cover it?

3. A refrigerator is to be lined with zinc. The inside measurements are: 4′ 6″ wide, 8′ high, 6′ 3″ deep. How many sq. ft. of zinc will be needed?

4. A room is 18 ft. long, 12 ft. wide, and 9 ft. high. Find the total area of the ceiling and the walls.

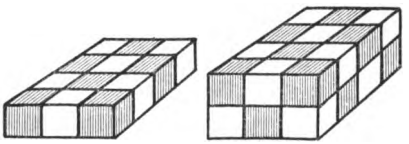
5. How many sq. ft. of wood will be needed to build a tool chest 6′ long, 2′ 4″ wide, and 3′ 6″ deep?

6. Find the total number of sq. yd. of plaster in the four walls of a room 27′ long, $14\frac{1}{2}$′ wide, and 10′ high.

7. What is the entire surface in sq. ft. of a rectangular boiler 72″ long, 28″ wide, and 40″ deep?

Volumes of Rectangular Solids. A rectangular solid whose three dimensions are equal is called a **cube**. It follows, therefore, that all six surfaces of a cube are equal, and are squares.

A cube one inch long, one inch wide, and one inch high contains one cubic inch. What is a cu. ft.? A cu. yd.?



Suppose that this solid is made up of one-inch cubes. How many one-inch cubes are there in the bottom layer? How many layers are there in the solid? Total number of cubes in it?

The **volume** of a solid is the amount of space that it occupies.

If a solid is 4 ft. long, 3 ft. wide, and 2 ft. thick, what is its volume?

Take the bottom layer of the solid shown above. It contains 12 small cubes, or $3 \times 4 = 12$ cubes.

There are 2 layers. Therefore, there are 24 cubes, or 2×12 cubes, in the solid.

The volume of a rectangular solid is equal to the product of the area of the base multiplied by the altitude.

ORAL EXERCISE

State what the volumes are of these solids:

1. $6' \times 15' \times 10'$
2. $4'' \times 8'' \times 6''$
3. 2 ft. $\times$ 3 ft. $\times$ 9 ft.
4. $12' \times 1\frac{1}{2}' \times 2''$
5. $28'' \times 10'' \times 20''$
6. 2 yd. $\times \frac{1}{4}$ yd. $\times$ 6 yd.

WRITTEN EXERCISE

1. What will it cost to excavate a cellar 16′ wide, 33′ long, and 9′ deep, at 72¢ a cubic yard?

2. If a bu. of corn occupies $1\frac{1}{2}$ cu. ft., how many bu. can be stored in a corn crib $35' \times 20' \times 15'$?

3. How many cu. in. of water will a tank hold, the dimensions of which are 10″ by $9\frac{1}{2}$″ by 8″?

4. A room is 40′ long, 35′ wide, and 22′ high. If there are 42 persons in the room, how many cu. ft. of air space is allowed for each one?

5. What will it cost to excavate a trench for a wall 81′ long, $1\frac{1}{2}$′ deep, and 2′ wide at 55¢ a cu. yd.?

6. A concrete wall is 48′ long, $1\frac{1}{3}$′ thick, and 24′ high. What will it cost to erect this wall at $6.15 a cu. yd.?

7. A ton of coal requires 36 cu. ft. of space. A coal bin is 9 ft. long and 8 ft. wide. How deep must the bin be to hold 10 tons of coal?

Measuring Lumber. Lumber is measured by board feet. A square foot of lumber 1 in. or less in thickness, is called a **board foot.** Lumber less than 1 in. thick is reckoned the same as lumber 1 in. thick.

Lumber dealers speak always of the thickness of board as it would be if there were no waste in planing. A board, bought as 1 inch, is always a little less than 1 inch; a 2-inch board is less then two inches. The same is true of buying lengths of boards. If an exact length is required the measurement must be given for the required length *after cutting.*

How many board feet in a board 24 ft. long, 8 in. wide, and 2 in. thick?

A board 24 ft. long $\times$ 8 in. wide $\times$ 2 in. thick =

$$\frac{\overset{2}{\cancel{24}} \times 8 \times 2}{\underset{1}{\cancel{12}}} = 32 \text{ board feet.}$$

Lumber is always quoted by the 1000 board feet, expressed as M. Thus, \$28 per M means \$28 per 1000 board feet.

WRITTEN EXERCISE

Find the number of board feet in:

1. A board 15′ long, 4″ wide, 2″ thick.
2. A board 12′ long, 6″ wide, 1″ thick.
3. A board 18′ long, 10″ wide, 2″ thick.
4. How many board feet are there in 12 pieces of stock 3″ $\times$ 9″, 15 feet long?
5. How many board feet in 30 boards, 3″ $\times$ 5″, each 12′ long?
6. Find the cost of 2200 board feet at \$24 per M.

Contents of Bins in Bushels. 2150.4 *cu. in. in a bushel.*

How many bushels of corn can be stored in a bin that is 10 ft. long, 8 ft. wide, and 4 ft. deep?

$$\frac{\overset{2}{\cancel{10}} \times \overset{}{\cancel{8}} \times \overset{}{\cancel{4}} \times \overset{9}{\cancel{1728}}}{\underset{.7}{\cancel{2150.4}}} = 256\tfrac{1}{7} \text{ bu.}$$

$\frac{1728}{2150.4}$ is approximately equal to fraction $\frac{4}{5}$.

Therefore, $\frac{\overset{2}{\cancel{10}} \times 8 \times 4 \times 4}{\underset{5}{\cancel{}}}$ or 256 bushels is the method adopted for all ordinary purposes.

WRITTEN EXERCISE

Compute the number of bu. in bins of the following dimensions:

1. $20' \times 8' \times 6'$
2. $10' \times 5' \times 4'$
3. $9' \times 12' \times 10'$
4. $4'\ 6'' \times 5' \times 8'$
5. $2'\ 4'' \times 3' \times 9'$
6. $8'\ 6'' \times 10' \times 9'$

7. The hold of a schooner is 38′ long, 20′ wide, and 7′ deep. Find the capacity in bushels.

Contents of Tanks in Gallons. The contents of tanks can be quickly computed.

There are 231 *cu. in. in a gallon.*

How many gal. are there in a tank 6 ft. long, 3 ft. wide, and 2 ft. deep?

$$\frac{6 \times \overset{3}{\cancel{9}} \times 2 \times 1728}{\underset{1}{\cancel{231}}\ \underset{77}{\cancel{3}}} = 269\tfrac{3}{77} \text{ gal.}$$

$\frac{1728}{231}$ is approximately equal to fraction $\frac{15}{2}$.

Therefore, $\frac{6 \times 3 \times \overset{1}{\cancel{2}} \times 15}{\underset{1}{\cancel{2}}}$ or 270 gallons is the method adopted for all ordinary purposes.

WRITTEN EXERCISE

Find the number of gal. in tanks of the following dimensions:

1. 3 ft. $\times$ 5 ft. $\times$ 4 ft.
2. 10 ft. $\times$ 2 ft. $\times$ 3 ft.
3. 15 ft. $\times$ 11 ft. $\times$ 2 ft.
4. 20 ft. $\times$ 3 ft. $\times 1\frac{1}{2}$ ft.

5. An oil tank is 4 ft. square and 18 in. high. How many gal. will it contain?

6. A disinfectant can has a capacity of 1617 cu. in. How many gal. will it hold?

7. A water tank is $8'\ 3'' \times 10' \times 12'\ 6''$. How many gal. will it hold?

The Metric System.

ORAL EXERCISE

1. What is the Metric System?
2. How does it compare with the English System?
3. Why is it necessary for you to understand the Metric System?
4. Recite the Table of Length; of Surfaces; of Volumes.
5. Recite the Table of Weights; of Capacity.
6. What is the difference between the prefixes:
   (*a*) deci and deka?
   (*b*) centi and hekto?
   (*c*) milli and kilo?

WRITTEN EXERCISE

1. After traveling 128 Km. from the garage, an automobile broke down. How many mi. had it traveled?
2. A girl weighs 42.3 Kg. How many pounds does she weigh?

Change to English equivalents these metric measures:

3. 34 l.	6. 203 Kg.	9. 9.8 m.
4. 24.8 Km.	7. 40 M. T.	10. 22 Hl.
5. 3.25 Dm.	8. 53 m.	11. 82 Km.

12. A junk dealer sells 3 metric tons of scrap iron at 4¢ a kilogram. How much does he receive?
13. An oil dealer orders 3000 l. of gasoline. About how many gal. does he order?

Change the following to the metric equivalents:

14. 15 mi.	16. 10 T.	18. 127 yd.
15. 40 gal.	17. 50 lb.	19. 140 mi.

20. How many lb. are there in 14 bags of flour, if each weighs 14 Kg.?
21. A French tire factory received a consignment of 8448 oz. of rubber. How many Kg. were there in the lot?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Find the number of which:		*Tell the results:*		
1.	4 is 25 %	60 is 125%	$4\times45¢$	\$5.46 + \$ .82	$40\div\frac{4}{5}$
2.	30 is 50 %	30 is 150%	$3\times82¢$	\$6.32 + \$ .39	$30\div\frac{3}{7}$
3.	20 is 40 %	40 is 250%	$9\times17¢$	\$7.48 + \$ .32	$50\div\frac{5}{8}$
4.	24 is $37\frac{1}{2}$%	270 is 300%	$8\times26¢$	\$9.01 + \$ .56	$24\div\frac{3}{11}$
5.	11 is $12\frac{1}{2}$%	800 is 200%	$7\times52¢$	\$5.60 + \$ .63	$36\div\frac{6}{7}$
	What per cent of:		*Read:*	*Tell the results:*	
6.	20 is 12?	72 is 12?	XLIV	\$3.22 − \$ .28	$5\times6\frac{1}{2}$
7.	64 is 24?	90 is 20?	CM	\$1.48 − \$ .37	$4\times7\frac{3}{4}$
8.	35 is 10?	90 is 45?	CIX	\$6.23 − \$ .43	$8\times9\frac{1}{8}$
9.	32 is 20?	90 is 90?	XCIX	\$4.18 − \$ .25	$5\times2\frac{1}{5}$
10.	18 is 15?	90 is 270?	CDLIX	\$1.72 − \$ .54	$7\times3\frac{1}{9}$
11.	80 qt. = ? pk.	3 yd. = ? in.	$28\times14\frac{3}{7}¢$	\$8.22 + \$ .78	$33\div\frac{2}{3}$
12.	40 oz. = ? lb.	72 hr. = ? da.	$48\times8\frac{1}{2}¢$	\$9.86 + \$ .80	$21\div\frac{3}{7}$
13.	$2\frac{1}{2}$ yr. = ? mo.	1 Kg. = ? lb.	$68\times6\frac{1}{4}¢$	\$3.40 + \$ .53	$60\div\frac{3}{10}$
14.	32 pk. = ? bu.	8 bu. = ? qt.	$16\times75¢$	\$7.22 + \$ .49	$81\div\frac{2}{9}$
15.	10 pk. = ? qt.	3 rd. = ? ft.	$36\times16\frac{2}{3}¢$	\$3.09 + \$ .72	$12\div\frac{3}{4}$
16.	£11 = ? \$	$\frac{3}{4}$ M. = ? ¢	$8\times\frac{1}{2}$%	\$9 ÷ \$1.12½	$18\div\frac{5}{6}$
17.	$\frac{1}{2}$ gr. = ? doz.	$8\frac{1}{2}$ ft. = ? in.	60×6 %	\$8 ÷ \$1.33⅓	$28\div\frac{7}{9}$
18.	8 bu. = ? qt.	50 R. = ? \$	84×50 %	\$11 ÷ \$1.37½	$32\div\frac{5}{8}$
19.	3 rd. = ? ft.	1 Kg. = ? lb.	$12\times\frac{3}{4}$%	\$14 ÷ \$1.16⅔	$42\div\frac{3}{7}$
20.	400 M. = ? \$	$4\frac{1}{2}$ gal. = ? qt.	$8\times\frac{1}{4}$%	\$16 ÷ \$1.14⅔	$54\div\frac{1}{5}$
21.	\$14.20 + \$3.40	\$11.20 − \$1.40	$8\times37\frac{1}{2}¢$	\$13 ÷ \$1.62½	$3\times2\frac{1}{3}$
22.	\$16.33 + \$5.60	\$12.33 − \$2.30	$24\times62\frac{1}{2}¢$	\$21 ÷ \$1.75	$7\times4\frac{1}{8}$
23.	\$18.25 + \$7.80	\$14.36 − \$3.40	$36\times75¢$	\$11 ÷ \$1.83⅓	$9\times3\frac{3}{7}$
24.	\$13.72 + \$4.20	\$15.04 − \$6.20	$48\times33\frac{1}{3}¢$	\$10 ÷ \$1.66⅔	$2\times6\frac{7}{9}$
25.	\$19.88 + \$1.80	\$11.93 − \$6.20	$56\times14\frac{2}{7}¢$	\$15 ÷ \$1.25	$6\times2\frac{3}{11}$
26.	\$20.65 + \$3.25	\$19.81 − \$3.30	$81\times11\frac{1}{9}¢$	\$25 ÷ \$1.82½	$4\times4\frac{4}{15}$

GENERAL WRITTEN PROBLEMS

1. What are the proceeds of a note of $250 dated Mar. 28, 1915 and due in 3 mo., discounted on Apr. 10, at 6%?

2. If gas is billed at 80¢ per 1000 cu. ft., what will be the cost of 3460 cu. ft. of gas?

3. A man bought a house and lot for $6835. He repaired the house at a cost of $1250. The house was burned and he received $3575 insurance. He then sold the lot for $4516. Did he gain or lose and what per cent?

4. How many sq. in. of felt will be needed to make a triangular flag of which the base is 2′ 4″ and the altitude 1′ 3″?

5. A cotton goods factory buys 150 bales of cotton, each containing 500 lb., at 14¢ a lb. If the agent receives $\frac{3}{4}$% commission, what is the total cost of the cotton to the manufacturer?

6. One side of a square field is 40 rd. long. How many acres are there in this field? What will it cost to fence it at 70¢ a rd.?

7. On Jan. 1, 1916, William Hendricks bought of the American Hardware Company, a bill of goods amounting to $850 for which he paid by giving his note due March 15, 1916, with interest at 5%. Write the note. What is the interest on the note when due?

8. What is the cost of plastering the walls and ceiling of a room 16′ long, 14′ wide, and 9′ high at $.75 a sq. yd.?

9. A street, half a mile long and 60 ft. wide, is paved with granite blocks. If 36 blocks are required to pave one sq. yd., how many will be required to pave the street?

10. A merchant bought potatoes at $1 a bushel and sold them at 30¢ a peck. How much did he gain on 76½ bushels? What % did he gain?

11. On June 20, 1917, Henry Bush borrowed of J. T. Adamson $800, payable in one year. On Sept. 15, Mr. Adamson discounted the note at 6%. How much less money did he receive from the bank than he paid Mr. Bush?

12. A corner plot of ground in the shape of a triangle is 280 rd. long at the base and 115 rd. in height. How many acres in this plot?

13. A class in cooking gave a luncheon for which the following material was used: 2 cans salmon at 10¢ a can; 4 eggs at 36¢ a dozen; $\frac{1}{3}$ of a peck of potatoes at 30¢ a peck; 2 cans peas at 10¢ a can; 2 quarts peaches at 25¢ a quart; flour 10¢; 1 pound butter at 37¢; 1 pound sugar at 9¢; other items 15¢. Sixteen persons were served. What was the cost per person?

14. The two sides forming the right angle of a right triangle are 38 ft. and 64 ft. Find the area in sq. yd.

15. An agent sold 1600 bu. of grain at 90¢ a bushel and sent his employer $1418.40 as the proceeds of the sale. What was the rate of the agent's commission?

16. After cutting, a block of marble is 8′ long, $2\frac{1}{2}$′ wide, and $1\frac{1}{2}$′ high. Find the total amount of surface to be polished if the marble is to be polished on all sides.

17. Three boys ran a relay race. The first ran exactly 1 Km. in 8 minutes; the second ran 1.3 Km. in 10 minutes; the third finished the race in the combined time of the other two. If the entire distance to be run was 5 Km., how did the speed of the third boy compare in per cent with that of each of the others?

18. What was the distance, in rd., run by each of the boys, in the preceding problem?

VI. BUSINESS FORMS AND PRACTICE

Bills and Invoices. Whenever a customer buys from a wholesale house a quantity of goods, the firm makes out and sends, generally with the goods, a list of the articles bought, the price of each, the place and the date of the sale, and the terms of the sale. This memorandum of goods shipped is called an **invoice**; from it, the purchaser *can check* the goods and note what he will be charged. Later, the bill itself will be sent him. This **bill**, as a rule, will duplicate the information contained in the invoice; but, the invoice is primarily a memorandum for the shipping and receiving departments, whereas the bill is in the nature of a notice of indebtedness, and is for the attention of the accounting departments.

Verify the results as computed in the following invoice. Why is it not receipted?

NEW ENGLAND SHOE COMPANY
BOSTON, MASS.

Oct. 26, 1917.

A. J. Cammeyer,
New York.

Oct.	24	10 cases French Kid	360 pr. $3.25	1170			
		20 cases Tan Calf	720 pr. $2.75	1980			
		15 cases Patent Calf	540 pr. $3.00	1620			
		20 cases Cordovan	720 pr. $3.75	2700			
				7470			
			Less 25, 10%	2427	75		
						5042	25

Bills with Several Discounts. Recall the method that has been used in deducting the two trade discounts. This short method is the one commonly used by many firms on both invoices and bills, although other methods are used also.

ORAL EXERCISE

1. If a cash discount be allowed by the New England Shoe Company, how much would that discount be on Mr. Cammeyer's bill?

2. Suppose that Mr. Cammeyer does not wish to pay for these goods at the regular time for paying, how can he arrange to meet his obligation with the N. E. Shoe Co.?

3. Tell how the discounts could have been deducted by other methods.

WRITTEN EXERCISE

Make out bills, inserting the necessary names and dates:

1. Bought of Alexander & Brady, 120 yd. Brussels carpet @ \$1.25; 360 yd. ingrain carpet at \$.75; 700 yd. moquette carpet at \$1.25. Discount 20 and 10%.

2. Bought of the United Fruit Company, 48 bunches bananas at \$1.20; 32 doz. pineapples at \$1.12½; 24 bags coffee, 132 lb. in a bag, at \$.16⅔ a lb. Discount 15%.

3. Bought of The G. E. Pfister Crockery Co., 18 doz. 12-oz. tumblers @ \$1.33⅓ a doz.; 9 sets dishes @ \$12.25; ½ gross crocks @ \$6.20; 3½ gross Mason jars @ \$2.80. Discount 10 and 5%.

4. Bought of Lord & Taylor, 5 men's shirts @ \$1.10; 1 overcoat @ \$22.50; 2 hockey caps @ \$.95; 6 pr. silk half hose @ \$.75; 1½ doz. collars @ \$.15 each. The employee buying these goods receive a discount of 10%.

5. The Eagle Hardware Company sold to M. A. Drought & Son, 400 lb. sheet zinc @ $.09; 2 doz. wheelbarrows @ $15.50; 1 doz. handsaws @ $7.50; 1½ doz. wrenches @ $12. Less 25 and 5%.

6. Write out an order on John Wanamaker for furniture, including four items. Refer to catalogue numbers. These goods are to be sent C.O.D.

7. From A. G. Spalding & Bros., order 4 one-piece swimming suits No. 4RL; ½ doz. white khaki gym. suits No. 102; 2 doz. tennis balls No. 52.

8. Write an order on Howard & Bates, Detroit, Mich., for 10 secretary book cabinets No. 4946; 18 Turkish rockers No. 54; 7 oak writing desks No. 39; 12 mahogany hall stands No. 1172; 3 reclining couches No. 14.

9. Make out a receipt for $48 rent of your apartment for next month.

10. Write out your receipt to John O. Ward for $14 paid to you on a debt amounting to $25.

11. Write out the receipt you would give the driver delivering the goods ordered in Example 1.

12. Make out a check to pay for the goods ordered in Example 2. Make out the stub of this check.

13. On Jan. 28, Russell E. O'Hara agrees to buy a bungalow for $1260. He is to pay 50% cash, 20% in 4 mo. at 3% interest, and the balance in 1 yr. at 6%. Draw checks on the Union Exchange Bank.

14. William G. Smallwood, accompanied by his wife, decides to take a cruise advertised by the Porto Rico Line with all expenses at $94.50. Write out the check that he mails, and the stub.

15. You deposit in a bank in your neighborhood $14.20 in coin, $22 in bills, and a check on the Empire Trust Co. for $45. Make out the deposit slip.

Methods of Sending Money. We sometimes have occasion to send money to some distant place. We may order goods in Baltimore and desire to send $18 in payment. This payment can be made by mailing a check, or if the buyer has no bank account the money may be sent by **registered mail.** By paying ten cents extra postage, one may **register the letter** at the post office. The post-office officials take every precaution to prevent the loss of registered letters, and when requested will return a receipt signed by the recipient of a registered letter. Another way to send payment safely is to purchase a **money order,** and mail that to the person owed.

Money Orders and Express Orders. A postal money order is an order made by a post office in one place on the post office in another place to pay a certain sum of money to some person named on the order.

To make use of this method, one must fill out an application blank obtainable at any post office, stating the name and address of the person to whom the money is to be paid, the amount to be paid, and the sender's name and address.

The money order clerk then writes out a money order, charging a small fee for the service. The person sending the money mails this order to the payee who can either cash it at the designated post office upon being identified, or deposit it in his bank like a check.

The charges for postal money orders are as follows:

From $ 0.01 to $ 2.50.... 3 cents	From $30.01 to $ 40.00....15 cents
From $ 2.51 to $ 5.00.... 5 cents	From $40.01 to $ 50.00....18 cents
From $ 5.01 to $10.00.... 8 cents	From $50.01 to $ 60.00....20 cents
From $10.01 to $20.00....10 cents	From $60.01 to $ 75.00....25 cents
From $20.01 to $30.00....12 cents	From $75.01 to $100.00....30 cents

For amounts over $100 additional orders must be purchased.

Money can also be " sent " by an **express money order.** These are secured from express companies, and may be cashed at any designated office of the issuing company.

The charges are about the same as for postal orders and the method of mailing them is the same. The advantage of express money orders is that they may be transferred any number of times the same as a check, while a postal money order may be transferred by indorsement once only.

WRITTEN PROBLEMS

1. How much more will it cost to send $65.02 by money order than by registered mail?

2. A school orders 26 geographies at $.48 each. If the money is sent by money order, how much more will the expense be than if payment is made by check?

3. A boy sends a money order for 1 infielder's glove at $2.25 and 2 doz. tennis balls @ $1.85 a doz. What will they cost?

Find the cost of money orders for each of the following amounts:

4. $14.02	7. $26.47	10. $5.65	13. $68.73
5. $ .98	8. $84.03	11. $24.15	14. $89.05
6. $37.46	9. $95.	12. $115.	15. $123.14

Personal and Cash Accounts. You have learned that the expression " personal account " may refer either to an account kept by a person to show his private receipts and expenses, or to an account kept by a business house with a customer showing the amounts of his purchases and his payments. This is also called a **ledger account.**

A cash account may refer either to an account kept by a business man to show how much he takes in and pays out, or it may refer to the account one keeps to show one's own receipts and expenditures.

Read again the two model accounts on pages 87 and 89.

PERSONAL ACCOUNT OF JOHN DONNELLY

CASH

1917	Dr.				1917	Cr.			
Mar.	18	Balance on hand	3	58	Mar.	18	Carfare		10
	19	Commission on ad.		60		19	Theatre		50
	21	From Uncle	1	00		20	Carfare		20
	23	From work done	1	35		22	Note book		15
	24	Weekly allowance	2	00		24	Fountain pen	2	00
							Balance	5	58
			8	53				8	53
Mar.	25	Balance on hand	5	58					

Notice that John Donnelly *debits* his account whenever he puts money into his pocketbook for his personal expenses, and that he *credits* his account whenever he pays out money. Finding the difference between the two sides of an account is called **balancing** the account.

WRITTEN EXERCISE

Make out cash accounts and find the balances:

1. On hand Nov. 28, $2.52; Nov. 29, paid carfare $.15; paid for lunch $.25; received for carrying satchel $.20; Nov. 30, received for shoveling snow $.30; paid for a movie theatre ticket, $.15; received for selling Saturday Evening Post $.85; Dec. 1, paid for gift $1.25; Dec. 2, received from father $2.00; paid for book, $.65; paid for carfare, $.10. Account was balanced Dec. 3.

2. On hand, Jan. 14, $425.06. Received from Street & Smith, $145; Jan. 15, paid rent, $55; paid gas bill $2.47; received from O. H. Oliver, $22.10; paid salaries, $72.50; received from Harper & Bros., $2.15; paid doctor, $10; received from F. H. Munsey Co., $85.60. Account was balanced Jan. 16.

3. On hand May 1, $24.16. Receipts: sales $44.10; G. H. Howe, $172.12; May 2, Jno. Wanamaker, $56.76; sales $102.03. May 3, sales $97.06; Hull, Griffen Co., $22.15; May 4, F. Lewis & Co., $35.39; sales, $114.10. Expenses: May 2, repairs $24.25; salaries $56.75; May 3, electric light bill, $15.85; May 4, J. H. Crowder & Co., $215.26. Account was balanced May 5.

4. Make out a personal account for two weeks, including ten items on each side. Balance the account.

5. On hand, Oct. 20, $56.75. Credits: Oct. 21, Cash, $22.00; clothes, $45.50; Oct. 22, shoes, $6.50; Oct. 23, railroad ticket, $5.45; Oct. 24, hotel bill, $12.45; Oct. 25, doctor's bill, $5. Debits: Oct. 21, salary, $75; Oct. 22, commissions $18.75. Balance the account.

6. Make out the cash account of a girl doing typewriting work. Balance Sept. 24, $4.85; paid for paper, $1.20; received from L. Mahler, $6.80; Sept. 25, paid for typewriter ribbon, $.50; received from Sonneborn & Son, $8.00; Sept. 20, paid month's rent of machine, $4; Sept. 27, paid for paper $1.60; Sept. 29, received from L. Mahler, $5.40; Sept. 30, bought erasers $.15, oil can $.10; received from S. Juryman, $1.45. Balance the account on Sept. 30.

7. Write out the cash account of Mrs. John Hooper for August. Cash on hand, Aug. 1, $9.25. On Aug. 1, 8, 15, 23 and 30, she received $15 for expenses. The expenses were: Aug. 3, grocer $4.11; butcher, $3.25. Aug. 7, laundry, $2.82; woman cleaning, $2.50. Aug. 14, grocer, $4.86; butcher, $4.05; gas bill, $3.62. Aug. 23, grocer, $5.14; butcher, $3.89; laundry, $4.02; telephone bill, $.85; baker's bill, $6.20. Aug. 30, grocer, $2.24; butcher, $5.46, baker, $.32. Balance the account.

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Find the bank discount at 6% on:			*Tell results:*	
1.	\$500, 60 da.	\$720, 60 da.	\$1200, 20 da.	$\frac{1}{8}+\frac{1}{7}$	$8\times\frac{2}{7}$
2.	\$700, 30 da.	\$800, 90 da.	\$1800, 10 da.	$\frac{9}{8}+\frac{9}{8}$	$9\times\frac{7}{8}$
3.	\$900, 90 da.	\$240, 90 da.	\$1400, 30 da.	$1\frac{1}{3}+\frac{1}{4}$	$7\times1\frac{1}{2}$
4.	\$240, 60 da.	\$640, 30 da.	\$2400, 24 da.	$1\frac{3}{4}+\frac{1}{2}$	$6\times\frac{4}{15}$
5.	\$400, 120 da.	\$3000, 60 da.	\$3000, 90 da.	$3\frac{1}{3}+\frac{2}{3}$	$12\times\frac{3}{5}$
6.	\$510, 120 da.	\$4200, 60 da.	\$3600, 90 da.	$\frac{4}{5}-\frac{1}{10}$	$\frac{4}{5}\div\frac{2}{5}$
7.	\$1000, 120 da.	\$5400, 30 da.	\$4600, 30 da.	$1\frac{1}{2}-\frac{3}{4}$	$\frac{3}{8}\div\frac{5}{8}$
8.	\$7000, 120 da.	\$6000, 30 da.	\$5500, 60 da.	$1\frac{3}{4}-\frac{1}{2}$	$\frac{8}{15}\div\frac{2}{15}$
9.	\$2000, 120 da.	\$1200, 70 da.	\$7200, 10 da.	$1\frac{3}{6}-\frac{5}{6}$	$\frac{2}{9}\div\frac{7}{9}$

	Find area of angles:		*Find contents:*	*Tell results:*	
	TRIANGLES	RECTANGLES			
10.	10′, 14′	$4\frac{1}{2}'\times11'$	$3\frac{1}{2}'\times2'\times4'$	6×17	$\frac{10}{12}\times\frac{24}{35}$
11.	20′, 15′	$16'\times70'$	$8''\times5''\times\frac{1}{2}''$	9×15	$\frac{4}{11}\times\frac{11}{8}$
12.	18′, 12′	$22'\times4\frac{1}{2}''$	$6'\times20'\times2\frac{1}{2}'$	8×18	$\frac{11}{12}\times\frac{36}{45}$
13.	27′, 14′	$15''\times3\frac{1}{3}''$	$\frac{3}{4}'\times12'\times14$	7×13	$\frac{4}{7}\times\frac{35}{40}$
14.	32′, 7′	$30''\times2''$	$28'\times4'\times10$	8×14	$\frac{5}{8}\times\frac{64}{70}$
15.	$6\frac{1}{2}'$, 8′	$14''\times\frac{1}{2}''$	$12''\times3''\times10$	$72\div4$	$56\div\frac{7}{9}$
16.	$3\frac{1}{4}''$, 4″	$6\frac{1}{2}'\times3'$	$30''\times2''\times5''$	$144\div8$	$84\div\frac{2}{3}$
17.	$\frac{1}{32}'$, 12′	2 rd. $\times\frac{1}{2}$ rd.	$16''\times\frac{1}{4}''\times20''$	$108\div12$	$32\div\frac{4}{5}$
18.	$6\frac{1}{3}'$, 9″	4 yd. $\times$ 12 ft.	$1\frac{1}{2}''\times\frac{1}{2}''\times10''$	$121\div11$	$48\div\frac{6}{7}$

Make change:

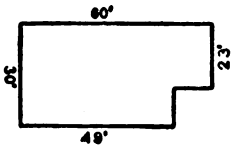
	\$1.00	\$2.00	\$5.00	\$10.00	\$20.00
19.	\$.23	\$ .74	\$1.15	\$3.23	\$ 7.82
20.	\$.89	\$ .69	\$1.25	\$4.37	\$ 9.25
21.	\$.33	\$ .88	\$2.30	\$5.16	\$11.36
22.	\$.65	\$1.12	\$3.12	\$6.25	\$14.15
23.	\$.49	\$1.63	\$4.26	\$7.10	\$16.73
24.	\$.13	\$1.79	\$4.89	\$8.43	\$18.05
25.	\$.37	\$1.48	\$2.68	\$6.35	\$12.77

GENERAL WRITTEN PROBLEMS

1. How much will a man receive on a non-interest-bearing note for $4800 due in 3 months, if he has it discounted at 5%, the day it is made?

2. I gave a grocer $5 to pay for 4 lb. tea at 62½¢ a lb., and 5½ lb. crackers at 8¢ a lb. What change should I receive?

3. This diagram represents the enclosed yard of a school building that is situated in the midst of a congested section of a large city. The school authorities have decided to lay a granolithic pavement over the entire yard. At $1.15 per sq. yd., what will it cost?



4. A house and lot cost $3600. The taxes were $52, insurance $8, and repairs $24 for the year. How much rent must the owner charge to obtain 6% clear on his investment of $3600?

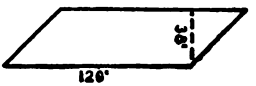
5. At $32 per ton, what is the cost of fertilizer for 600 young peach trees, allowing 1¼ lb. to a tree?

6. A lady ordered by mail and enclosed a money order in payment: 1 serge dress @ $19.75, 3 blouses @ 65¢, 1 hat at $1.95 and 6½ yd. voile @ 25¢. What was the total cost of the goods and the money order?

7. What are the bank discount and proceeds of a 4-months' note for $860, dated Mar. 26, and discounted Apr. 10, at 6%?

8. A steamer unloads 147½ tons of grape sugar. What is the amount of the duty on this consignment at 1⅜¢ a lb.?

9. A real estate broker sold at auction this city lot. The price obtained for it was $11,400. For how much per sq. ft. did the land sell?



10. What is the discount and the proceeds of a note for \$225, discounted at 5% for 75 days?

11. A certain man placed money in a bank as follows: Jan. 1, \$82.55; Feb. 3, \$98.79; Feb. 21, \$79.89; Mar. 2, \$82.79; May 3, \$937.49; June 1, \$328.59; July 3, \$492.89; July 29, \$193.75; Aug. 2, \$849.70; Aug. 15, \$593.29. He drew from the bank the following amounts: May 8, \$92.75; June 15, \$129.83; July 6, \$19.75; Aug. 5, \$399.50; Sept. 5, \$298.65. How much money has he still in the bank?

12. A customer is offered a discount of 30 and 20% on a bill of \$2200, or a discount of 40 and 10%. Which discount should he accept and how much will he save?

13. If I lend \$820 at 6% for 1 yr. 3 mo. and 12 da., what amount shall I receive at the end of that period?

14. At 11¢ per sq. ft., find the cost of laying a concrete walk 5 ft. wide, along the front and one side of a corner lot 80 ft. wide and 60 ft. deep. Represent the lot and the walk by a diagram.

15. The tax rate for a certain year is \$.187 per dollar. How much will the tax amount to on property assessed at \$26,400?

16. The tariff on cigars is \$4.50 a lb. specific duty and 25% ad valorem. What is the duty on a shipment weighing 825 lb. and valued at \$2520?

17. Write a cash account containing the following items: Balance, July 5, \$7.50; received salary, \$38. July 7, received rent, \$25. July 8, paid tailor, \$18.25; paid board, \$16. July 9, deposited in bank, \$48. July 10, received commission, \$22.86. July 12, received salary, \$38; paid railroad fares, \$8.75. July 15, paid board, \$16. Find the balance on July 16.

VII. SIMPLE EQUATIONS: OPTIONAL WORK

Use of the Equation in Percentage.

(*a*) Out of \$275 spent for repairs on an automobile, \$44 was spent for tires. What per cent was spent for tires?

Let x = the per cent spent for tires

Then $\$2.75x = \$44$ (Divide each side of the equation by \$2.75)

And $\frac{\$2.75x = \$44}{\$2.75 = \$2.75}$

\$2.75)\$44.00

16%

(*b*) 15% of a number is 1350. What is the number?

Let x = the number

Then $.15x = 1350$ (Divide each side of the equation by .15)

And $\frac{.15x = 1350}{.15 = .15}$

.15)1350.00

9000

(*c*) By selling a car for \$1425, a dealer made a gain of 15%. How much did the car cost?

Let x = the cost of the car

Then $.15x$ = the gain

And $x + .15x = \$1425$ or $1.15x = \$1425$

1.15)\$1425.00

\$1240

WRITTEN EXERCISE

1. A man earned \$2450 last year, which was 40% more than he earned the preceding year. How much did he earn that year?

2. A storekeeper sold goods at 12% less than cost. The goods were sold for \$3.57. What did they cost?

3. An agent sold 173 subscriptions to a two-dollar magazine, earning \$86.50. What was his rate of commission?

4. A furniture dealer sold library tables for \$33.55, thereby making a profit of $37\frac{1}{2}\%$. How much did the goods cost him?

5. A coffee plantation yielded 40% more coffee the second season than the first. If the second yield was 840 bags, how many bags were there in the first crop?

6. A second-hand automobile can be bought for \$2015. This is 65% of the price of a new car. How much does a new car cost?

7. A store keeper sold shirts at 20% less than the marked price, yet gained $16\frac{2}{3}\%$. At what price were they marked, if they cost him \$1.80 apiece?

8. A man's income is \$2920 a year. If he spends \$730 a year for board, what per cent of his money does his board cost him?

9. If the commission is \$19.50 and the rate is $\frac{1}{2}\%$, what is the value of the goods sold?

10. An agent charges 5% for his services in collecting an unpaid bill and remits \$1748.38. How much did he collect?

11. The price of a bookbinding machine, after a discount of 15% was allowed, was \$705.67. What was the list price?

12. A property owner received a tax bill of \$162.35. If the rate was 17 mills, what was the assessed value of the property?

13. An automobile truck was sold for \$1925 at a loss of 30% of the cost. What was the loss?

14. What per cent of \$3525 is \$528.75?

15. What per cent of \$7922 is \$5703.84?

The Use of the Equation in Interest.

(*a*) At what *rate* must \$400 be invested to earn an interest of \$65 in 3 yr. 3 mo.?

Let x = the rate

Then $\frac{\$x}{100}$ = the interest on \$1 for 1 yr.

And $3\frac{1}{4} \times \frac{\$x}{100}$ of \$400 = \$65 or $\frac{13 \times \$x \times \$400}{4 \quad 100} = \$65$

$$\frac{13x = \$65}{13 \;\; 13} = 5\%$$

(*b*) In what *time* will \$300 at 6% yield \$39 in interest?

Let x = the time

Then $\frac{\$6x}{100} \times \$300 = \$39$ or $\frac{\$6x \times \$300}{100} = \$39$

And $\frac{\$18x = \$39}{18 \;\; 18} = 2\frac{1}{6}$ yr. or 2 yr. 2 mo.

(*c*) What *principal* invested at 4% will earn an interest of \$1500 in 2 yr. 6 mo.?

Let x = the principal

Then $2\frac{1}{2} \times \frac{\$4x}{100} = \$1500$

And $\frac{5 \times \$4x}{2 \quad 100} = \$1500$ or $\frac{\$x}{10} = \$1500$ or $\frac{\$10x = \$15000}{10}$

Therefore x = \$15,000

ORAL EXERCISE

1. At what rate will \$100 gain \$10 in 1 yr.? Analyze.
2. In what time will \$100 yield \$10 at 5%? Analyze.
3. What sum will earn \$100 at 4% in 4 yr.? Analyze.

WRITTEN EXERCISE

At what rate will:

1. \$960 earn \$100.80 interest in 2 yr. 4 mo.?

[Study carefully (*a*) on preceding page.]

2. \$450 earn \$153 interest in 5 yr. 8 mo.?
3. \$2700 earn \$540 interest in 3 yr. 4 mo.?
4. \$960 earn \$9.60 interest in 90 da.?
5. A man deposits \$1450 in a bank. Eight months later, he was credited with \$29 interest. What rate of interest did that bank pay?

In what time will:

6. \$2500 yield \$175 at 6%

[Study carefully (*b*) on preceding page.]

7. \$750 yield \$250 at 6%?
8. \$1500 yield \$40.50 at 4½%?
9. \$1440 yield \$168 at 5%?
10. For how long a period must I leave \$2500 in a bank that pays 4½% interest in order that my deposit may amount to \$2968.75?

What principal will gain an interest of:

11. \$450 in 3 yr. at 5%?

[Study carefully (*c*) on preceding page.]

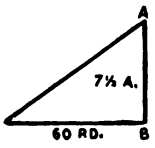
12. \$156.60 in 2 yr. 3 mo. at 4%?
13. \$294 in 2 yr. 4 mo. at 6%?
14. \$13.80 in 80 da. at 6%?
15. At the end of 3 mo., the value of a note, bearing interest at 6%, was \$14.70. What was the face of the note?

GENERAL WRITTEN PROBLEMS

1. Soap that a druggist bought at \$1.20 a dozen cakes is so damaged that he has to sell it for 8¢ a cake. What was his loss on 165 dozen? What was his per cent of loss?

2. Find the total cost of the following loads of coal at \$6.25 per ton: 3849 lb.; 2935 lb.; 4832 lb.; 2364 lb.; 2837 lb.; 4378 lb.; 1352 lb.

3. A new road was cut by the county through a farming region. This road cut one of the farms in such a way that a field was left on one side of the road shaped like this diagram. How many ft. of wire fencing will be required to enclose the new side AB?



4. The duty on 40 doz. woolen blankets invoiced at \$2.20 each was \$264. What was the ad valorem rate?

5. A dealer has three pieces of silk containing 13⅛ yd., 21¼ yd., and 16½ yd., respectively. At 80¢ a yd., what must be paid for these three pieces?

6. How much will it cost to excavate a ditch 180′ long, 4′ wide, and 6′ deep, at \$.68 a cu. yd.?

7. What is the amount of \$1480 for 2 yr. 2 mo. 15 da. at 4½%?

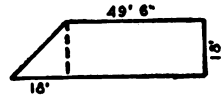
8. Mr. Brown sent to a commission firm 480 bu. of potatoes and 500 bu. of beans. The potatoes were sold at 72¢ a bu. and the beans at 98¢ a bu. If the firm charged 2½% commission, what amount was sent to the consignor?

9. A man purchased a house for \$5000. The first year the expenses for repairs were \$45, for taxes \$75, for insurance \$10. If the house was rented for \$40 a month, what per cent did he clear on his investment that year?

10. A family purchased 47½ lb. of meat per month at an

average price of \$.267 per lb. If other foods are substituted for the meat at an average cost of \$5.23 per month, how much money will be saved thereby in a year?

11. Mr. Hardy bought from a real estate agent a lot of land shaped like this diagram. He agreed to pay at a certain price per sq. ft., so it was necessary to know just what the area was. What was it?



12. If \$540.10 is left in the bank to draw 4% interest from Aug. 8, 1915 to Dec. 20, 1917, to how much will it amount?

13. If a boy rides $23\frac{3}{8}$ mi. on a bicycle in $2\frac{3}{4}$ hr., what is his average rate per hour?

14. A tank measures 9 ft. in length, 4 ft. 6 in. in width, and 6 ft. in depth. How many sq. ft. of zinc will be needed to line it?

15. A dealer buys cash registers listed at \$75 for 20 and 15% off. He sells them at 12% off the list price. How much does he gain on each register?

16. What is the perimeter of a triangle whose sides are 9 ft. 4 in., $2\frac{1}{2}$ yd., 7 ft. 11 in.?

17. A 60-day note for \$2450, dated Dec. 10, 1917, with interest at 6%, was discounted Jan. 9, 1918, at 6%. What was the bank discount?

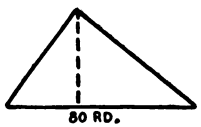
18. A dealer buys 320 yd. of cloth at $87\frac{1}{2}$¢ a yd. At what price per yd. must he sell it in order to make a profit of \$40?

19. What is the total duty on a shipment of perfumery weighing 430 lb. and valued at \$1150, if there is a specific duty of 40¢ a lb. and an ad valorem duty of 60%?

20. A lady made purchases as follows: 5 pk. potatoes at 35¢ a pk.; $\frac{1}{2}$ doz. eggs at 38¢ a doz.; $2\frac{1}{2}$ lb. meat at 28¢ a lb.; 2 doz. oranges at 30¢ a doz. She gave a five-dollar bill in payment. How much change should she receive?

21. A property owner pays a tax of $155.77 on his dwelling. If the tax rate is $1.85 on $100, what was the assessed value of the property?

22. This diagram represents a 10-A. field. The owner has decided to run a wire fence across it as indicated by the dotted line. If the area at the left of the fence is to be $\frac{2}{5}$ of the entire field, how much will this fence cost at 8¢ a ft.?



23. On July 1, 1917, David Mosler bought of Henry A. Atkinson a bill of goods amounting to $820, for which he paid by giving his note due Sept. 15, 1917 with interest at 5%. Write the note. Compute the interest on the note when due.

24. A man bought a horse for $175 and sold it for $210. What was the per cent of his profit in this transaction?

25. The distance around a rectangular field is 196 rods. If the field is 56 rods long, how many acres does it contain?

26. A pedlar bought 491 yd. of cloth at 81¢ a yd. He used 29 yd. and sold the remainder at 95¢ a yd. Did he gain or lose? How much? What per cent?

27. The contents of a storage house were damaged by fire and sold for $8476, which was 48% less than the original value. Find the original value.

28. An automobile was sold for $782. This was an increase of 15% on the cost. What did the car cost?

29. A traveler bought a table-set in Austria for 495 crowns. How much was this in our money?

30. A steamer passage from San Francisco to Tokyo is 710 Yen. What is the cost in American money?

31. How much interest is due on $850 loaned May 16, 1915, at 5½% and paid Feb. 21, 1917?

TABLES FOR REFERENCE

Avoirdupois Weight

16 ounces (oz.)	= 1 pound (lb.)
100 pounds	= 1 hundredweight (cwt.)
2000 pounds (20 cwt.)	= 1 ton (T.)
2240 pounds	= 1 long ton (L. T.)

Troy Weight

24 grains (gr.)	= 1 pennyweight (dwt.)
20 pennyweights	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.)

---

1 oz. avoir. = 437½ gr. troy
1 lb. avoir. = 7000 gr. troy

Liquid Measure

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)

31½ gal. = 1 barrel (bbl.)
2 bbl. = 1 hogshead (hhd.)

1½ gal. = 231 cu. in.
7½ gal. = about 1 cu. ft.

Dry Measure

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

---

1 bu. = 2150.42 cu. in., or about 1¼ cu. ft.

Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
365 days = 1 common year (yr.)
366 days = 1 leap year
12 months (mo.) = 1 year
10 years = 1 decade
10 decades or 100 years = 1 century (cen. or C.)

Thirty days has September,
April June, and November;
All the rest have thirty-one,
Excepting February alone,
To which we twenty-eight assign,
Till leap year gives it twenty-nine.

Counting

2 units = 1 pair (pr.)
12 units = 1 dozen (doz.)
12 dozen = 1 gross (gr.)
12 gross = 1 great gross (gr.gr.)
20 units = 1 score

Paper Measure

24 sheets (sht.) = 1 quire (qr.)
20 quires or 480 sheets = 1 ream (rm.)

---

500 sheets are usually called a ream.

Linear Measure

12 inches (in.) (″) = 1 foot (ft.) (′)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods or 1760 yards or 5280 feet = 1 mile (mi.)

---

4 in. = 1 **hand**; 6 ft. = 1 **fathom**; 40 rd. = 1 **furlong**;
6080.27 ft. = 1 **knot**, or nautical mile = about 1.15 land mi.

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards or $272\frac{1}{4}$ square feet = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mi. (sq. mi.)

---

36 square miles = 1 township
640 acres = 1 section
160 acres = 1 quarter-section

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
128 cubic feet of wood = 1 cord (cd.)

Wood, when cut, is usually stacked in piles 8 ft. × 4 ft. × 4 ft.
These piles, containing 128 cu. ft., are called cords; $\frac{1}{8}$ of a cord, or a layer of wood 4 ft. × 4 ft. × 1 ft., is called a cord foot.

Useful Equivalents

1 barrel (bbl.) = 31½ gal. = 4⅕ cu. ft.
1 hogshead (hhd.) = 63 gal.
1 gallon (gal.) = 231 cu. in.
1 bushel (bu.) = 2150.42 cu. in. = 1¼ cu. ft.
1 ton of coal = 35 cu. ft.
1 cu. ft. of water = 62½ lb.

1 bu. of wheat	= 60 lb.	1 bbl. of beef	= 200 lb.
1 bu. of corn	= 56 lb.	1 bbl. of pork	= 200 lb.
1 bu. of rye	= 56 lb.	1 bu. of oats	= 32 lb.
1 bbl. of flour	= 196 lb.	1 bu. of potatoes	= 60 lb.

Circular Measure

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circumference

---

90 degrees, or ¼ of a circumference, is called a **quadrant.**
An angle of 90 degrees is called a right angle.

United States Money

10 mills = 1 cent (ct., c., or ¢)
10 cents = 1 dime (di.)
10 dimes = 1 dollar ($)
10 dollars = 1 eagle (*in gold only*)

---

1 cent (copper) is called a penny;
5 cents (nickel) is called a nickel;
25 cents (silver) is called a quarter;
50 cents (silver) is called a half-dollar;
20 dollars (gold) is called a double-eagle.

Foreign Moneys

COUNTRY	STANDARD	EXACT VALUE	APPROX. VALUE
Argentina	Peso	$.965	$1.00
Austria	Crown = 100 heller	.203	.25
Belgium	Franc	.193	.20
Bolivia	Boliviano	.389	.40
Brazil	Milreis	.546	.50
Canada	Dollar	1.00	1.00
Central Am.	Peso	.435	.50
Chile	Peso	.365	.40
China	Tael { Canton	.711	.70
	Tael { Haikwan	.726	.70
	Tael { Shanghai	.651	.70
Colombia	Dollar	1.00	1.00
Denmark	Crown	.268	.25
Ecuador	Sucre	.487	.50
Egypt	Pound = 100 piasters	4.943	5.00
France	Franc = 100 centimes	.193	.20
Germany	Mark = 100 pfennig	.238	.25
Great Britain	Pound = 20 shillings	4.8665	5.00
	Shilling = 12 pence	.2433	.25
	Penny = 4 farthings	.0203	.02
Greece	Drachma	.193	.20
Hayti	Gourde	.965	1.00
Holland	Florin or Gulden	.402	.40
India	Rupee	.324	.30
Italy	Lira = 100 centesimi	.193	.20
Japan	Yen = 100 sen	.498	.50
Mexico	Peso	.498	.50
Norway	Crown	.268	.25
Panama	Balboa	1.00	1.00
Peru	Libra	4.8665	5.00
Portugal	Milreis	1.08	1.00
Russia	Ruble = 100 kopecks	.515	.50
Spain	Peseta	.193	.20
Sweden	Crown	.268	.25
Switzerland	Franc	.193	.20
Turkey	Piaster	.044	.05
Uruguay	Peso	1.034	1.00
Venezuela	Bolivar	.193	.20

See page 71.

METRIC SYSTEM

Linear Measure

10 millimeters (mm.) = 1 **centimeter** (cm.)
10 centimeters = 1 **decimeter** (dm.)
10 decimeters = 1 **meter** (m.)
10 meters = 1 dekameter (Dm.)
10 dekameters = 1 hektometer (Hm.)
10 hektometers = 1 **kilometer** (Km.)
10 kilometers = 1 myriameter (Mm.)

---

1 centimeter = about $\frac{2}{5}$ inch
1 decimeter = amost 4 inches
1 meter = 39.37 inches
1 kilometer = about $\frac{5}{8}$ mile

Square Measure

100 sq. millimeters (sq. mm.) = 1 sq. centimeter (sq. cm.)
100 sq. centimeters = 1 sq. decimeter (sq. dm.)
100 sq. decimeters = 1 sq. meter (sq. m.)
100 sq. meters = 1 **sq. dekameter** (sq. Dm.)
100 sq. dekameters = 1 sq. kilometer (sq. Km.)

The sq. dekameter is the standard for the measurement of land and is called the **are.**

Land Measure

100 centares (ca.) = 1 are (a.)
100 ares = 1 **hektare** (Ha.)

The hektare is 2.471 acres (approx. 2½ acres).

Cubic Measure

1000 cu. millimeters (cu. mm.) = 1 **cu. centimeter** (cu. cm.)
1000 cu. centimeters = 1 **cu. decimeter** (cu. dm.)
1000 cu. decimeters = 1 **cu. meter** (cu. m.)

The cu. cm. is used to get the **standard of weight.**
The cu. dm. is used to get the **standard of capacity.**
The cu. m. is used to get the **standard of wood measure.**

Measures of Weight

10 milligrams (mg.)	= 1 centigram (cg.)
10 centigrams	= 1 decigram (dg.)
10 decigrams	= 1 **gram** (g.)
10 grams	= 1 dekagram (Dg.)
10 dekagrams	= 1 hektogram (Hg.)
10 hektograms	= 1 **kilogram** (Kg.)
10 kilograms	= 1 myriagram (Mg.)
10 myriagrams	= 1 quintal (Q.)
10 quintals	= 1 **metric ton** (M. T.)

The gram is the weight of 1 cu. cm. of distilled water, and is about $\frac{1}{28}$ oz. avoirdupois.

The kilogram, or kilo, equals 2.2046 lb., and is used in weighing ordinary groceries, etc.

The metric ton equals 1.1023 English tons, approx. 2204 lb., and is used for weighing coal, iron, etc.

Dry and Liquid Measures

10 milliliters (ml.)	= 1 centiliter (cl.)
10 centiliters	= 1 deciliter (dl.)
10 deciliters	= 1 **liter** (l.)
10 liters	= 1 dekaliter (Dl.)
10 dekaliters	= 1 **hektoliter** (Hl.)
10 hektoliters	= 1 kiloliter (Kl.)

The liter is used to measure milk, etc., and equals approximately the quart: .908 qt. dry; 1.0567 qt. liquid.

The hektoliter is used to measure potatoes, etc., and is the equivalent of 2.8377 bushels.

The kiloliter is used to measure hay, etc., and is not used commonly.

Land Measure

10 decisteres (ds.)	= 1 stere (s.)
10 steres	= 1 dekastere (Ds.)

The stere approximates $2\frac{1}{5}$ cord feet of cut wood.

The dekastere is a little more than $2\frac{3}{4}$ cords.

INDEX

	PAGE
Accident insurance	31, 118
Account, cash	87, 180
ledger	180
personal	89, 180, 181
statement of	65
Acute angle	159
triangle	160
Addition	2, 105
Ad valorem duty	130
Altitude	160, 161, 166
Amount	46
net	34
Angles	159
Apex	159
Applications of percentage	113
Arabic numerals	3
Area of parallelogram	163
of rectangle	162
of triangle	164
Balance	87
Balancing an account	181
Bank, borrowing from	149
discount	147
Banker's 60-day method	138
Banks, commercial	62
of deposit	62
savings	57
Base, in percentage	13, 19
of figures	159, 161, 166
Bills	82, 83, 176, 177
Blank, indorsement in	145
Board foot	169
Bonds, postal savings	61
Borrowing money	46, 136, 147, 149
Broker, commission	26
Brokerage	26
Business forms and practice	81, 176
Cancellation, use of	48
Capacity, metric table of	78, 199
Cards, postal savings	61
Cash account	87, 180
discount	33
Centimeter	74
Change, making	5
Check	64
City tax	41
Commercial banks	62
discounts	33
Commission	25, 115
broker	26
merchant	25
Companies, insurance	117
Consignee	25
Consignment	25
Consignor	25
Contents of tanks in gallons	171
Cost	21
Credit	83, 87
Creditor	84, 87
Cube	168
Customs, revenue	129
Days of grace	143
Debit	87
Debtor	84, 87
Decimals, changing per cents to	14
review of	10, 108
Demand notes	141

	PAGE
Depositing money	62
Deposit slip	62
Deposits, banks of	62
interest on	60
Diagonal	161
Discount, bank	147
Discounts	33–36, 120–127
Division	7, 106
short methods in	106, 107
Drawer	64, 142
Duties	129–132
Endowment policy	119
Entry, ports of	129
Equation	95
Equations, simple	93, 186
solving	96
use of in interest	188
use of in percentage	99, 186
use of in problems	98
Equilateral triangle	160
Equivalents, foreign money	71
metric	74
table of per cent	15
Exchange	71
Express money order	179, 180
Face of note	142
of policy	32
Farm tax	41
Fire insurance	31, 118
Foot, board	169
Foreign money	70–73, 197
Fractions, changing per cents to	13
review of	8, 108
Free list	130
Full, indorsement in	145
Grace, days of	143
Gram	79
Height	161
Hektoliter	78
Income tax	37, 129
Indorsement of notes	144, 145
Indorser	149
Indorsing a check	64
Insurance	31, 32, 117–120
Interest	46–54, 136–141
on deposits	60
use of equations in	188
Interest-bearing notes	143, 153
Internal revenue tax	129
Investing money	57
Invoice	83, 176
Isosceles triangle	160
Kilogram	74, 79
Ledger account	180
Legal rate	143
Lending money	46, 136
Length, metric table of	76, 198
Letters, representing numbers	93
Life insurance	119
List, free	130
price	33
Liter	74, 78
Loss, profit and	21–24, 113–115
Lumber, measuring	169
Mail, registered	179
Maker	142
Making change	5
Marine insurance	31, 118
Marked price	126
value	130
Maturity	142
Meaning of taxes	36
Measurement	70, 159

PAGE

Measuring lumber 169
Meter 74, 76
Method, bankers' 60-day . . 138
Methods of sending money . . 179
Metric equivalents 74
system . . . 74–80, 172, 198
table of capacity . . . 78, 199
table of length . . . 76, 198
table of weights . . . 79, 199
ton 79
Money, borrowing and lending 46, 136, 149
depositing 62
foreign 70–73, 197
methods of sending . . . 179
order, express . . . 179, 180
order, postal 179
saving and investing . . 57
Monthly statement 85
Multiplication 7, 106
short methods in . . 106, 107
Municipal taxation:
New York City 38
Philadelphia 41

National revenue 129
Negotiable notes 145
Net amount 34
price 34, 122
proceeds 25
weight 131
New York City, municipal taxation 38
Non-interest-bearing notes . . 143
Non-negotiable notes 145
Notation and numeration . . 3
Note, demand 141, 143
face 142
indorsement of . . 144, 145
interest-bearing 143

PAGE

Note, negotiable 145
non-interest-bearing . . 143
non-negotiable 145
promissory 141–155
term of 147
time 141, 142
Numbers, represented by letters 93
Numerals, Arabic 3
Roman 4
Numeration, notation and . . 3

Obtuse angle 159
triangle 160
Oral drill exercises 11, 43, 55, 67, 90, 110, 133, 156, 173, 183
Order, express money . . 179, 180
postal money 179
Orders for goods 81
Overhead 21, 113

Parallelogram 161
area of 163
Pass book 57
Payee 64, 142
Payment, in full to date . . . 86
on account 86
Per cent equivalents, table of . 15
rate 13, 17
Per cents, changing decimals to 14
changing fractions to . . 13
changing to decimals . . 14
Percentage 13
applications of 113
use of equations in . . 99, 186
Perimeter 159
Periods 3
Personal account . . 89, 180, 181
Personal property 36
Philadelphia taxes 41
Policy 32

	PAGE
Policy, endowment	119
face of	32
straight life	119
Poll tax	41
Ports of entry	129
Postal money order	179
savings bonds	61
savings cards	61
savings stamps	61
savings system	59
Practice, business forms and	81, 176
Prefixes, use of	75
Premium	32, 117
Price list	33
marked	126
net	34, 122
Principal	46
Problems, general written	12, 44, 56, 68, 91, 102, 111, 134, 157, 174, 184, 190
Proceeds	147
net	25
Profit and loss	21–24, 113–115
Promissory notes	141–155
Property, personal	36
Quadrilaterals	161
Raising money for taxes	39
Rate, legal	143
of insurance	118
of interest	46
per cent	13, 17
tax	37, 41
Real estate	36
Receipts	85, 86
Recourse, indorsement without	145
Rectangle	161
area of	162
Rectangular solids	167, 168
Registered mail	179
Restrictive indorsement	145
Revenue, customs	129
internal	129
national	129
Reviews	1, 105, 108, 136
Right angle	159
Right triangle	160
Right-angled triangle	160
Roman numerals	4
Saving and investing money	57
Savings	119
banks	57
Sending money, methods of	179
Sheet, discount	124
Shipment	25
Short methods in division	106, 107
in interest	49, 138
in multiplication	106, 107
Simple equations	93, 186
Single discount equal to successive	124
Six per cent method	49, 138
optional variations of	140
Slip, deposit	62
Solid, rectangular	167
Solving equations	96
Specific duty	130
Square	161
Stamps, postal savings	61
State tax	41
Statements	83, 85
of account	65
Straight life policy	119
Stub	64
Subtraction	3, 5, 106
Suburban tax	41
Successive discounts	121, 176
Surface of rectangular solids	167

	PAGE
Surplus	117
Table of foreign money equivalents	71, 197
of per cent equivalents	15
Tables for reference	193–199
Tanks, contents of in gallons	171
Tare	131
Tariff	129
Tax rate	37, 41
Taxation, municipal: New York City	38
Taxes	36–42, 127–132
Term of discount	147
of note	147
Time	46
notes	141, 142
Ton, metric	79
Trade discounts	33
Triangle	159
acute	160
altitude of	160, 166
area of	164
base of	159, 166
equilateral	159, 160
isosceles	159, 160
obtuse	160
right	159, 160
Value, marked	130
Volume	168
Weight, net	131
Weights, metric table of	79, 199
Wholesale prices	25
Writing orders for goods	81

CONTENTS

EIGHTH YEAR BOOK

FIRST HALF: GRADE 8 A

		PAGE
I.	Review of Fundamental Operations	1
II.	Applications of Percentage	18
III.	Money and Interest	22
IV.	Measurement	34
V.	Ratio and Proportion	50
VI.	Industrial Problems	60
VII.	Business Forms: Household Accounts	67
VIII.	Simple Equations: Optional Work	76

SECOND HALF: GRADE 8 B

I.	Practice with Numbers	82
II.	Review of Applications of Percentage	90
III.	Money: Banks and Banking	97
IV.	Insurance	116
V.	Taxes	123
VI.	The Business of Corporations	131
VII.	Measurement	145
VIII.	Business Forms: Household Accounts	165
IX.	Simple Equations: Optional Work	167
Tables for Reference		175
Index		183

ARITHMETIC BY GRADES

EIGHTH YEAR BOOK

FIRST HALF: GRADE 8A

I. REVIEW OF FUNDAMENTAL OPERATIONS

Rules to Remember in All Your Work:

1. In business the only passing mark in arithmetic is 100%.
2. The *rapid* answer is desired, but never at the sacrifice of *correctness.*
3. Write figures neatly and clearly, the horizontal lines level and the columns straight.
4. Perform operations by the shortest method you know.
5. *Check every result* before you lay down your pencil. In checking addition, add the columns in reverse order, or omit the last addend the second time and add it to the total you secure.

ORAL DRILL IN ADDITION

State totals rapidly:

1.	2.	3.	4.	5.	6.	7.	8.
8	6	7	5	6	8	8	5
3	5	4	3	5	4	5	6
7	4	8	5	3	9	7	7
1	2	3	2	4	5	6	5

Horizontal Addition. In business it is often necessary to find totals of numbers written in a horizontal line. Items are sometimes written this way on bills, invoices, stock lists, sales sheets, and pay rolls.

WRITTEN EXERCISE

Add the following by rows and by columns; check results:

1. $22+48+16+39=$
   $96+84+29+93=$
   $49+56+84+91=$
   $63+56+28+70=$
   $75+69+33+89=$
   $__+\ +\ +\ +\ =$

2. $36+44+55+60+79=$
   $84+26+72+42+16=$
   $23+39+42+76+87=$
   $47+15+79+90+48=$
   $56+28+93+47+64=$
   $+\ +\ +\ +\ =$

3. $349+846+794+496=$
   $674+495+465+651=$
   $159+271+975+635=$
   $928+392+246+505=$
   $124+198+143+175=$
   $+\ +\ +\ =$

4. $246+144+713+516=$
   $536+624+724+275=$
   $472+758+589+491=$
   $649+541+627+238=$
   $763+492+864+639=$
   $+\ +\ +\ =$

A corporation pays salaries as follows; state the three totals:

5. Officers: \$75.50, \$90.75, \$125.50, \$150.75, \$200.50.
6. Stenographers: \$30.50, \$28.75, \$25.50, \$21.25, \$17.
7. Clerks: \$20, \$18, \$17.50, \$15.25, \$12, \$10.50, \$10.

A stock clerk has on hand the following lengths, in yards, of goods. Find the total number of yards in each group, and the value:

8. Duck: 82, 91, 46, 53, 67, 84, 75, 65, 69, @ \$.75 a yd.
9. Voile: 15, 93, 88, 73, 29, 87, 43, 41, 40, @ \$.24 a yd.
10. Taffeta: 92, 89, 67, 83, 72, 56, 58, 71, 84, @ \$1.40 a yd.
11. Crêpe: 83, 95, 42, 69, 84, 75, 96, 94, 74, @ \$1.65 a yd.

WRITTEN SPEED DRILL

Add each of the following and note the number of seconds required. Drill on the addition to reduce the time limit:

1.	2.	3.	4.
6165	1663	37,563	34,962
8474	9181	29,784	49,638
3296	4975	54,190	34,543
4589	9268	45,496	58,475
6695	1425	69,235	54,109
5753	5496	95,462	18,246
5298	6857	87,560	31,774
4976	7453	41,258	28,298
6173	8246	36,048	45,237

Add the above examples horizontally. Check results by adding the column totals, and then adding the side totals.

ORAL EXERCISE IN SUBTRACTION

What change should be given for each cash item at the left if the amounts at its right represent the purchases?

$ .50	$ .23	$ .17	$ .39	$ .41	$ .26	$ .33	$ .12
1.00	.87	.64	.40	.82	.35	.49	.76
1.00	.39	.19	.22	.65	.07	.14	.59
2.00	.25	.39	1.15	.86	1.49	1.67	1.89
2.00	1.69	1.17	1.30	1.88	1.72	1.04	.93
5.00	3.25	2.65	4.82	1.30	3.22	.59	4.87
10.00	4.60	2.35	1.15	5.70	8.45	7.20	6.90
20.00	5.80	17.25	14.20	3.90	16.70	2.80	11.10

WRITTEN EXERCISE

Subtract and check:

1.	2.	3.	4.
57,445	32,643	275,411	243,101
48,978	24,987	167,894	184,956

Subtract and check:

5. 391,775 248,986	**6.** $2208.75 989.87	**7.** $62,642.21 47,857.62
8. 519,765 419,875	**9.** $45,487.62 31,898.75	**10.** $82,337.46 67,559.08

ORAL DRILL

Tell the sum and the difference rapidly:

1.	40 15	90 23	30 17	50 28	80 36	20 11	60 39	50 21
2.	30 22	70 56	80 31	76 46	46 28	54 35	57 22	88 29
3.	$.34 .26	$.81 .57	$.24 .16	$.45 .17	$.72 .28	$.93 .46	$.56 .37	$.24 .11

ORAL EXERCISE IN MULTIPLICATION

1. Preliminary to examples **2–9,** tell how many times each of the following amounts is contained in $1:

25¢	75¢	$12\frac{1}{2}$¢	$62\frac{1}{2}$¢	$33\frac{1}{3}$¢	$8\frac{1}{3}$¢	$83\frac{1}{3}$¢
50¢	$6\frac{1}{4}$¢	$37\frac{1}{2}$¢	$87\frac{1}{2}$¢	$66\frac{2}{3}$¢	$16\frac{2}{3}$¢	$14\frac{2}{7}$¢

Tell the cost of each of the following items:

2. 72 lb. tongue	@ $.37$\frac{1}{2}$	**6.** 10 qt. cider	@ $.06$\frac{1}{4}$
3. 96 yd. ribbon	@ .08$\frac{1}{3}$	**7.** 48 qt. milk	@ .16$\frac{2}{3}$
4. 84 gal. oil	@ .66$\frac{2}{3}$	**8.** 66 yd. lawn	@ .33$\frac{1}{3}$
5. 56 qt. beans	@ .14$\frac{2}{7}$	**9.** 132 yd. serge	@ .83$\frac{1}{3}$

Multiply each number by 10; *by* 100; *by* 1000:

10. 4.86	**13.** 11.14	**16.** .76	**19.** .0234
11. .0007	**14.** 64.65	**17.** 6.415	**20.** 325.16
12. 57.145	**15.** .00743	**18.** 23.75	**21.** 460.12

Multiply mentally and tell the results:

22. 86×200	**28.** 432×200	**34.** 71×3000
23. 521×20	**29.** 232×700	**35.** 83×6000
24. 320×80	**30.** 460×500	**36.** 333×200
25. 221×90	**31.** 900×400	**37.** 600×2000
26. 453×2000	**32.** 500×200	**38.** 457×2000
27. 241×3000	**33.** 322×400	**39.** 612×3000

ORAL EXERCISE IN DIVISION

Divide each number by 10; *by* 100; *by* 1000:

1. 5460	**5.** 831	**9.** 1450	**13.** 19,436
2. 26.30	**6.** 88.90	**10.** 3560	**14.** 20,000
3. 373.5	**7.** 2248	**11.** 546.30	**15.** 36,370
4. 496.4	**8.** 5368	**12.** 80.497	**16.** 92,035

How many tons of copper ore in:

17. 14,000 lb.?	**20.** 64,000 lb.?	**23.** 22,300 lb.?
18. 434,000 lb.?	**21.** 286,000 lb.?	**24.** 347,000 lb.?
19. 78,500 lb.?	**22.** 984,000 lb.?	**25.** 578,000 lb.?

TESTS OF DIVISIBILITY

A number is exactly divisible by:

2, *if the last digit is* 2, 4, 6, 8, *or* 0.

3, *if the sum of its digits is divisible by* 3.

4, *if the number represented by the two right-hand figures is divisible by* 4.

5, *if it ends in* 5 *or* 0.

6, *if divisible by* 2 *and by* 3.

8, *if the number represented by the three right-hand figures is divisible by* 8.

9, *if the sum of its digits is divisible by* 9.

10, *if it ends in* 0.

12, *if divisible by* 3 *and by* 4.

SHORT METHODS OF MULTIPLYING AND DIVIDING

To multiply by:

5, *multiply by* 10 *and divide by* 2.
50, *multiply by* 100 *and divide by* 2.
25, *multiply by* 100 *and divide by* 4.
250, *multiply by* 1000 *and divide by* 4.
125, *multiply by* 1000 *and divide by* 8.
$12\frac{1}{2}$, *multiply by* 100 *and divide by* 8.
75, *multiply by* 300 *and divide by* 4.
$33\frac{1}{3}$, *multiply by* 100 *and divide by* 3.
$66\frac{2}{3}$, *multiply by* 200 *and divide by* 3.
$16\frac{2}{3}$, *multiply by* 100 *and divide by* 6.
$83\frac{1}{3}$, *multiply by* 500 *and divide by* 6.
$37\frac{1}{2}$, *multiply by* 300 *and divide by* 8.
$62\frac{1}{2}$, *multiply by* 500 *and divide by* 8.
$87\frac{1}{2}$, *multiply by* 700 *and divide by* 8.

To divide by:

5, *multiply by* 2 *and divide by* 10.
50, *multiply by* 2 *and divide by* 100.
25, *multiply by* 4 *and divide by* 100.
250, *multiply by* 4 *and divide by* 1000.
125, *multiply by* 8 *and divide by* 1000.
$12\frac{1}{2}$, *multiply by* 8 *and divide by* 100.
75, *multiply by* 4 *and divide by* 300.
$33\frac{1}{3}$, *multiply by* 3 *and divide by* 100.
$66\frac{2}{3}$, *multiply by* 3 *and divide by* 200.
$16\frac{2}{3}$, *multiply by* 6 *and divide by* 100.
$83\frac{1}{3}$, *multiply by* 6 *and divide by* 500.
$37\frac{1}{2}$, *multiply by* 8 *and divide by* 300.
$62\frac{1}{2}$, *multiply by* 8 *and divide by* 500.
$87\frac{1}{2}$, *multiply by* 8 *and divide by* 700.

WRITTEN EXERCISE

Using short methods, multiply and also divide by 25 *by* $12\frac{1}{2}$:

1. 5.6 2. 24.8 3. 48.8 4. 724 5. 6.32

Multiply and also divide by $33\frac{1}{3}$; *by* $66\frac{2}{3}$:

6. .84 7. 4.74 8. 9.87 9. 74.1 10. 1200

Multiply and also divide by $37\frac{1}{2}$; *by* $62\frac{1}{2}$:

11. 1.68 12. .72 13. 33.6 14. .024 15. 33.28

WRITTEN PROBLEMS

1. The value of 250 Pullman cars manufactured in three years was $4,575,000. What was the value of the average car?

2. If $16\frac{2}{3}$ lb. of steel are used in manufacturing a machine gearing, how many gearings can be made from two shipments of steel each containing $52\frac{1}{2}$ T.?

3. A British munition factory turned out 12,375 three-inch shells. If a freight car carries 125 shells, how many cars will be required to carry the output?

4. A milling firm decides to send one day's output of flour in $12\frac{1}{2}$-lb. bags. If the output is 92,500 lb., how many bags should be ordered?

5. In $87\frac{1}{2}$ hours a binding machine turned out 358,750 bound magazines. Find the number bound in an average hour.

Find the cost of each of the following items:

6. 5616 yd. ribbon @ $16\frac{2}{3}$¢.
7. 9136 yd. corduroy @ $87\frac{1}{2}$¢.
8. 3744 lb. bacon @ $87\frac{1}{2}$¢.
9. 8457 gal. floor polish @ $66\frac{2}{3}$¢.
10. 4208 lb. smoked ham @ $37\frac{1}{2}$¢.

REVIEW OF COMMON FRACTIONS

WRITTEN EXERCISE

In the dry goods business, small numbers written above and to the right of numbers indicating yards, are used to show quarter yards. For example: 26^3 yd. means $26\frac{3}{4}$ yd.; 74^1 yd. means $74\frac{1}{4}$ yd.

Tell the total of yards in the six lengths in each of the following four examples:

1.	54^1	63^3	28^1	32^2	44^3	55^1
2.	72^3	61	49^3	47^1	54^3	52^1
3.	81^1	83^2	79^2	75^3	78^2	79
4.	13^3	19^1	24^2	14^2	15^2	18^2

5. Find the totals of the following pay roll; check results:

EMPLOYEE'S NUMBER	HOURS WORKED EACH DAY						TOTAL HOURS	RATE PER HOUR	AMOUNT DUE
	MON.	TUE.	WED.	THURS.	FRI.	SAT.			
546	$5\frac{3}{4}$	$6\frac{1}{2}$	$8\frac{1}{4}$	$8\frac{3}{4}$	$7\frac{1}{2}$	$6\frac{3}{4}$		$.48	$
616	$6\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{3}{4}$	8	$7\frac{3}{4}$	$6\frac{3}{4}$		$.60	
547	8	$7\frac{1}{2}$	$6\frac{1}{4}$	$6\frac{3}{4}$	$6\frac{3}{4}$	$7\frac{1}{2}$		$.48	
587	$5\frac{3}{4}$	$9\frac{1}{2}$	$4\frac{1}{4}$	$7\frac{1}{2}$	$9\frac{1}{4}$	$8\frac{1}{2}$		$.56	
534	$7\frac{3}{4}$	$7\frac{3}{4}$	$8\frac{1}{2}$	$4\frac{3}{4}$	$8\frac{3}{4}$	$4\frac{1}{2}$		$.60	
540	$8\frac{3}{4}$	$6\frac{1}{2}$	$5\frac{1}{4}$	$8\frac{1}{4}$	$6\frac{3}{4}$	$4\frac{1}{2}$		$.44	
541	$4\frac{1}{4}$	$8\frac{1}{4}$	$7\frac{3}{4}$	$8\frac{3}{4}$	$5\frac{1}{2}$	$6\frac{1}{4}$		$.28	
604	$8\frac{1}{2}$	$5\frac{3}{4}$	$8\frac{3}{4}$	$7\frac{1}{4}$	$7\frac{1}{2}$	$8\frac{3}{4}$		$.40	
								TOTAL	$

ORAL DRILL

1.	$\frac{1}{12}+\frac{1}{7}$	$\frac{1}{4}-\frac{1}{7}$	$4\times\frac{7}{9}$	$\frac{8}{9}\div 2$	$\frac{4}{9}\div\frac{2}{5}$
2.	$\frac{1}{8}+\frac{1}{5}$	$\frac{1}{5}-\frac{1}{10}$	$\frac{7}{9}\times 36$	$\frac{6}{7}\div 3$	$\frac{5}{7}\div\frac{5}{8}$
3.	$\frac{1}{4}+\frac{1}{9}$	$\frac{1}{3}-\frac{1}{7}$	$\frac{3}{4}\times 56$	$\frac{3}{5}\div\frac{3}{4}$	$\frac{7}{9}\div\frac{1}{2}$
4.	$\frac{3}{5}+\frac{3}{5}$	$\frac{1}{4}-\frac{1}{5}$	$\frac{5}{6}\times 54$	$\frac{1}{3}\div\frac{7}{9}$	$\frac{5}{6}\div\frac{3}{5}$

WRITTEN EXERCISE

Add or subtract as indicated:

1. $\frac{1}{3}+\frac{1}{2}+\frac{1}{6}+\frac{5}{9}+\frac{14}{15}+\frac{4}{45}$
2. $\frac{1}{3}+\frac{1}{9}+\frac{2}{27}+\frac{3}{4}+\frac{11}{12}+\frac{19}{36}$
3. $5\frac{2}{3}+7\frac{1}{2}+8\frac{5}{6}+11\frac{3}{4}+9\frac{5}{12}$
4. $8\frac{3}{4}+11\frac{2}{3}+18\frac{4}{5}+7\frac{1}{2}+4\frac{1}{4}$
5. $4\frac{1}{2}+12\frac{3}{4}+6\frac{6}{7}+5\frac{1}{2}+9\frac{5}{14}$
6. $3\frac{2}{3}+9\frac{4}{5}+7\frac{1}{2}+16\frac{5}{6}+4\frac{4}{5}$
7. $7\frac{2}{7}-4\frac{2}{5}$
8. $8\frac{2}{3}-1\frac{1}{2}$
9. $27\frac{7}{8}-4\frac{3}{11}$
10. $13\frac{5}{9}-9\frac{2}{3}$
11. $41\frac{4}{5}-3\frac{1}{7}$
12. $9\frac{1}{8}-8\frac{1}{2}$
13. $13\frac{5}{8}-4\frac{4}{5}$
14. $13\frac{3}{11}-7\frac{3}{4}$
15. $54\frac{1}{2}-11\frac{5}{6}$
16. $34\frac{5}{9}-16\frac{7}{12}$
17. $6\frac{3}{4}-4.25$
18. $5\frac{4}{5}-3.75$
19. $11\frac{1}{8}-10.6$
20. $78\frac{2}{7}-26.5$
21. $22\frac{5}{12}-14.5$

Multiply or divide as indicated:

22. $\frac{5}{7}\times 4\frac{3}{5}$
23. $\frac{8}{9}\times 9\frac{2}{3}$
24. $\frac{3}{4}\times 11\frac{1}{2}$
25. $\frac{3}{20}\times\frac{11}{16}\times\frac{48}{85}\times\frac{17}{30}$
26. $\frac{2}{3}\times\frac{9}{20}\times\frac{7}{18}\times\frac{33}{35}$
27. $\frac{7}{8}\times\frac{2}{3}\times\frac{21}{22}\times\frac{11}{38}$
28. $\frac{6}{7}\times 3\frac{7}{8}$
29. $4\frac{1}{5}\times 7\frac{1}{4}$
30. $3\frac{2}{3}\times 5\frac{4}{5}$
31. $11\frac{1}{2}\div 4\frac{5}{9}$
32. $3\frac{3}{7}\div 1\frac{2}{3}$
33. $9\frac{7}{8}\div 2\frac{1}{5}$
34. $12\frac{1}{8}\div 3\frac{1}{4}$
35. $9\frac{1}{2}\div 8\frac{5}{8}$
36. $8\frac{3}{5}\div 4\frac{1}{2}$
37. $4\frac{2}{7}\div 1\frac{3}{5}$
38. $11\frac{1}{3}\div 7\frac{5}{6}$
39. $9\frac{1}{2}\div 6\frac{1}{4}$
40. $7\frac{5}{6}\div 4\frac{1}{7}$
41. $9\frac{3}{5}\div 5\frac{1}{6}$
42. $30\frac{1}{2}\div 9\frac{5}{8}$

REVIEW OF DECIMAL FRACTIONS

WRITTEN EXERCISE

1. Add each column; add each line across; check results:

86.423	+	132.5	+	.345	+	9.643	+	.8	
4.527	+	42.673	+	2.84	+	18.41	+	47.043	
8.16	+	8.4	+	71.024	+	1.3454	+	61.243	
11.045	+	9.721	+	18.543	+	222.75	+	11.06	
8.96	+	88.046	+	1.723	+	19.634	+	1.743	
3.405	+	177.076	+	47.418	+	4.8	+	12.009	
37.39	+	42.15	+	3.035	+	28.545	+	203.54	
	+		+		+		+		

Find these remainders:

2. $\frac{9}{16} - .25$	5. $83.9 - 23\frac{1}{4}$	8. $14\frac{1}{4} - 8.72$
3. $3\frac{1}{2} - 2.75$	6. $98\frac{4}{5} - 12\frac{7}{8}$	9. $52\frac{5}{8} - 45.75$
4. $24\frac{1}{4} - 12.15$	7. $12.127 - 3.33\frac{1}{3}$	10. $55\frac{2}{3} - 48.83\frac{1}{3}$

Find these products:

11. $246 \times .305$	17. 54.26×2.43	23. 275.4×956.6
12. $7.28 \times .0083$	18. 352.20×4609	24. 208.5×15.18
13. 721.3×296	19. 5.162×486	25. $.1019 \times 2.512$
14. $4856 \times .8065$	20. $9.87 \times .00876$	26. $84.75 \times .7577$
15. 8.246×63.72	21. 1200.6×9.137	27. $95.507 \times .1005$
16. $.02456 \times 984.73$	22. $.00765 \times 54.6$	28. $.02456 \times 984.73$

Divide and check:

29. $22{,}986 \div .27$	34. $19{,}528 \div 19.2$	39. $67{,}200 \div 240$
30. $14{,}698 \div 4.2$	35. $24{,}450 \div 1.75$	40. $72{,}468 \div 3.52$
31. $.091512 \div .0124$	36. $345.144 \div 394$	41. $468.860 \div 4.76$
32. $766{,}300 \div .00079$	37. $7.5522 \div 2.46$	42. $3351.04 \div 37.4$
33. $2099.247 \div .3607$	38. $1402.01 \div 893$	43. $278.499 \div 5.79$

WRITTEN PROBLEMS

1. A milk firm paid bills for hay amounting to \$6962.08. If 424 T. were used, find the average cost per T.

2. The U. S. Army pays \$1.85 each for trench shovels. How many shovels can be ordered with an appropriation of \$8325?

3. A city set aside \$2664 for treating the trees in the public parks. If the parks contained 1184 trees in need of treatment, what amount could be spent on the average tree?

4. During the summer a dairyman sold 53,559 quarts of milk. If he supplied 297 families, how many quarts of milk were used by the average family?

5. If 65 sheep cost \$1337.50, what will 29 sheep cost?

REVIEW PROBLEMS

1. A sales girl has remnants of ribbon measuring $\frac{3}{4}$ yd., $2\frac{3}{8}$ yd., $1\frac{5}{16}$ yd., and $3\frac{1}{3}$ yd. How many yards of the ribbons has she in stock?

2. A builder orders glass for a display window 10.48 ft. wide. The standard size glass is $9\frac{3}{4}$ ft. wide. How much wider is the window than the standard width glass?

3. A merchant keeps $\frac{1}{3}$ of his money in one bank, $\frac{1}{4}$ of it in another, and the remainder in a third bank. If he keeps $1440 in the first bank, how much money has he in each of the other banks?

4. A wholesale grocer bought a cargo containing 12,800 lb. cocoa at $13\frac{5}{8}¢$ a lb. If his manufacturing cost was $\frac{3}{4}¢$ a lb. and he sold the product at $23\frac{1}{2}¢$ a lb., how much was his profit?

5. A young man spent $\frac{1}{4}$ of his money for a motor cycle and had $637.50 left. How much money had he at first?

6. A retail dealer bought two pieces of silk, one containing 18.75 yd. at $2.75 a yd., and the other containing 13.6 yd. at $3.12\frac{1}{2}$ a yd. He sold both pieces at $2.94 a yd. Did he gain or lose, and how much?

7. A boy working in a shop finds that with a hand plane he can dress a pine board 3 ft. long, 1 ft. wide, and 1 in. thick in five minutes; if he uses a machine planer he can dress a board of the same width and thickness but four times as long in 15 seconds. How many feet of board can he dress on the machine in $1\frac{1}{2}$ hr.? How many with the hand plane?

8. The product of two fractions is $\frac{17}{84}$. If one of them is $\frac{2}{3}$, find the other.

9. Find the cost of 19,000 bricks at $8.75 per M.

10. It costs \$1.57 per T. to ship wheat from Chicago to New York by water, and \$3.30 per T. to send it by rail. On a shipment of 68,000 hundredweight how much would be saved if it were shipped by water?

11. A steamer made a passage of 1103.52 mi. in 60.8 hours. Find the average speed per hour.

12. If a bushel contains 2150.42 cu. in., how many cu. in. will $9\frac{1}{4}$ bu. of grain occupy?

13. A load of lime weighed 1520 lb. What decimal part of a T. did it weigh?

14. There are 6080.27 ft. in a knot. If a vessel has steamed 10 knots, how many miles has it traveled?

15. The floor of a room $18' \times 14'$ is partly covered by a rug $14' \times 7'$. At $1\frac{3}{4}¢$ a sq. ft., find the cost of varnishing the part of the floor not covered by the rug.

16. A girl paid 75¢ for a frame for a hat, \$1.60 a yd. for $1\frac{1}{4}$ yd. velvet, and \$3.75 for other trimmings. If the making cost \$2.25, what was the total cost of the hat?

17. A grocer buys a barrel of olive oil containing 33 gal. 3 qt. If he decides to sell this oil in pints, how many pint bottles will be used?

18. At 55¢ a cu. yd. how much will it cost to excavate a cellar 42 ft. long, 26 ft. wide, and $7\frac{1}{2}$ ft. deep?

19. If a motor boat has a speed of 14.25 mi. per hour, how long will it take to travel 62.7 mi.?

20. At the rate of $12\frac{1}{2}$ mi. an hour, how long will it take a train to run 1086.25 mi.?

21. What is the profit on 86 ladies' suits manufactured for \$9.80 each, and sold for \$13.75?

22. A bin is 20′ long, 8′ 6″ wide, and 6″ deep. How many bu. of oats will it contain?

23. How much must I pay for $18\frac{2}{3}$ yd. braid at $7\frac{3}{4}¢$ a yd.?

24. An agent sold 91 loads of oats at \$.65 a bushel, the loads averaging 35 bu. 2 pk. How much did he receive?

25. A room, occupied by 39 pupils and a teacher, is 36′ long, 16½′ high, and 26½′ wide. How many cu. ft. of air space is allowed for each person?

26. A marble monument contains 220 cu. ft. If the slab is 6′ long and 3′ 4″ wide, how high is it?

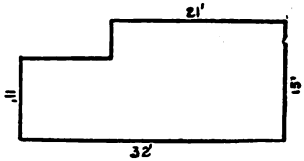
27. Find the area of a yard in triangular form whose base is 45′ 4″, and whose altitude is 39′ 6″.

28. Find the perimeter of a rectangle 3 yd. 1 ft. 7 in. long and 2 yd. 2 ft. 11 in. wide.

29. How many square inches of copper will be required to cover the surface of a wooden cube 8 inches long?

30. A freight elevator can raise a maximum weight of 240 lb. per sq. ft. What is the maximum load for an elevator 6½′ long and 8′ wide?

31. How much will it cost to cement the floor of this cellar at \$1.15 a sq. yd.? What is the perimeter of the cellar in ft.?



32. How many sq. ft. of tin will be needed to line the inside of an ice box 3′ 4″ high, 2′ wide, and 3′ 6″ deep (inside measurement)?

33. If a French franc is worth \$.193, how much French money should a traveler receive for \$372? How much is 250 fr. worth in our money?

34. A Chicago importing house buys a bill of goods amounting to £1820 15s. How much American money is required to settle the bill?

35. A salesman reported that his hotel bill in Germany averaged 16 M. for 26 days. What did the total hotel expense amount to in United States money?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	$\$9 \div \$1.12\frac{1}{2}$	$20 \times 25¢$	$\$6 \div \$1.50$	$32 \times 6\frac{1}{4}¢$	$20 \div \frac{2}{3}$
2.	$\$8 \div \$1.33\frac{1}{3}$	$28 \times 50¢$	$\$10 \div \$1.25$	$24 \times 8\frac{1}{3}¢$	$18 \div \frac{3}{4}$
3.	$\$7 \div \$1.16\frac{2}{3}$	$24 \times 75¢$	$\$13 \div \$1.62\frac{1}{2}$	$18 \times 66\frac{2}{3}¢$	$24 \div \frac{4}{5}$
4.	$\$8 \div \$1.14\frac{2}{7}$	$32 \times 37\frac{1}{2}¢$	$\$10 \div \$1.66\frac{2}{3}$	$32 \times 12\frac{1}{2}¢$	$30 \div \frac{5}{6}$
5.	$\$11 \div \$1.37\frac{1}{2}$	$40 \times 62\frac{1}{2}¢$	$\$11 \div \$1.83\frac{1}{3}$	$30 \times 33\frac{1}{3}¢$	$28 \div \frac{7}{8}$

Count the change:

	$2.00	$5.00	$1.00	$10.00	$1.00
6.	$ .39	$ .36	$.13	$5.11	$.29
7.	1.15	3.75	.84	3.02	.82
8.	.69	2.10	.42	7.27	.63
9.	1.46	1.16	.07	2.25	.21
10.	.49	3.65	.27	8.49	.12

	What part of:	*Tell the answers:*			
11.	14 is 12?	16 is $\frac{4}{7}$ of ?	$\frac{4}{9}$ of 72	$\frac{2}{3}$ of 48	6×17
12.	20 is 14?	30 is $\frac{2}{5}$ of ?	$\frac{12}{7}$ of 84	$\frac{3}{4}$ of 60	8×14
13.	18 is 12?	60 is $\frac{3}{4}$ of ?	$\frac{6}{5}$ of 55	$\frac{5}{6}$ of 36	9×15
14.	50 is 40?	24 is $\frac{3}{11}$ of ?	$\frac{4}{3}$ of 90	$\frac{7}{8}$ of 56	11×12
15.	70 is 56?	10 is $\frac{5}{12}$ of ?	$\frac{3}{11}$ of 88	$\frac{4}{5}$ of 40	13×13

State results:

16.	20 is $\frac{5}{6}$ of ?	60 lb. @ $33\frac{1}{3}¢$	$69 \div 3$	$\frac{1}{2}$ of 78	$98 \div 7$
17.	12 is $\frac{3}{8}$ of ?	56 lb. @ $62\frac{1}{2}¢$	$129 \div 3$	$\frac{5}{13}$ of 39	$84 \div 6$
18.	18 is $\frac{2}{3}$ of ?	80 lb. @ $25¢$	$112 \div 7$	$\frac{7}{6}$ of 54	$96 \div 4$
19.	15 is $\frac{3}{7}$ of ?	48 lb. @ $37\frac{1}{2}¢$	$115 \div 5$	$\frac{1}{7}$ of 84	$64 \div 16$
20.	15 is $\frac{5}{9}$ of ?	96 yd. @ $62\frac{1}{2}¢$	$121 \div 11$	$\frac{1}{9}$ of 108	$76 \div 19$

	Find the interest on $100 *for:*		*Find values:*		
21.	5 mo. at 6%	2 mo. at 3%	60 lb. @ $75¢$	26×4	$\frac{7}{8} + \frac{7}{8}$
22.	4 mo. at 3%	6 mo. at 6%	75 yd. @ $50¢$	38×5	$\frac{1}{3} + \frac{1}{5}$
23.	10 mo. at 6%	4 mo. at 6%	88 yd. @ $25¢$	16×8	$1\frac{1}{3} + \frac{1}{4}$
24.	1 yr. at $2\frac{1}{2}$%	3 yr. at 5%	40 yd. @ $75¢$	39×7	$1\frac{3}{5} + 1\frac{3}{5}$
25.	1 yr. at $12\frac{1}{2}$%	9 mo. at 4%	72 yd. @ $83\frac{1}{3}¢$	17×16	$3\frac{1}{3} + \frac{3}{4}$

GENERAL WRITTEN PROBLEMS

1. The standing in arithmetic of an eighth grade pupil was as follows: Sept., 89%; Oct., 85%; Nov., 91%; Dec., 85%; Jan., 96%; Feb., 87%; Mar., 89%; Apr., 97%; May, 96%; June 88%. Find his monthly average for the school year.

2. William Dean's bank balance on Monday is $1117.56. During the week he deposits: $104.25, $628.75, $438.16, $200.65, $387.38, $456.97. He draws checks for $56.90, $100, $456.28, and $850. What is his balance on Saturday at the close of business?

3. On a war map, a length of $\frac{3}{4}''$ represents a distance of 420 mi. How many mi. will a length of $2\frac{5}{8}''$ represent?

4. A bushel of corn weighs 56 lb. What will it cost to ship 3425 bu. from Ohio to Chicago, if the freight charge is 16¢ a hundredweight?

5. A lot 125′ long and 64′ wide is enclosed by a fence 5′ high. How much will it cost to paint both sides of this fence at 22¢ a sq. yd.?

6. A man purchased 8 chairs at $4.25 each and 3 tables at $7.39 each. How much change should he have received from 6 ten-dollar bills?

7. Find what these goods will cost me: 24 yd. crêpe de Chine @ $1.28; 17 yd. black satin @ $1.78; 87 yd. Persian lawn @ $.24; $92\frac{1}{2}$ yd. cotton voile @ $.24.

8. A butcher bought 5 doz. turkeys, a net weight of 720 lb., at $.22 a lb. If his selling expenses were $2\frac{1}{4}$¢ a lb., how much did he gain by selling the turkeys at an average price of $3.48?

9. In one year a large typewriter factory paid to 619 employees $623,003.04 in wages. Find the average yearly wages per employee.

10. What is the interest on \$620 at $4\frac{1}{2}\%$ from Sept. 25, 1917, to Mar. 20, 1918?

11. The cellar of a house is 22′ long, 16′ wide, and 7′ deep. In order to put in a furnace and a coal bin, the cellar must be made 27′ long, 16′ wide, and $8\frac{3}{4}$′ deep. How many cu. ft. of earth must be removed?

12. A dealer pays \$.34 a doz. for eggs and sells them at the rate of 10 eggs for \$.45. How much will he make on 320 doz. eggs?

13. Find the amount of the following bill:

8 bbl. medium mackerel	@	\$9.40
5 bbl. split herring	@	4.85
400 lb. cod	@	.06$\frac{1}{4}$
600 lb. cod	@	.07$\frac{1}{2}$
6 bbl. large mackerel	@	13.30

14. From a bushel of clams, a dealer secures $1\frac{3}{4}$ gallons. In order to fill a 31-gallon barrel, how many bushels of clams must he open?

15. A family uses $3\frac{1}{3}$ lb. of butter a week for a month of 31 days. At 45¢ a lb., how much will the butter cost?

16. How many acres in a triangular lot having a base of 80 rd. and an altitude of 330 ft.?

17. Find the amount of the sales check for the following:

$8\frac{1}{3}$ yd. taffeta	@	\$1.30
$6\frac{3}{4}$ yd. chiffon	@	1.20
$5\frac{1}{2}$ yd. muslin	@	.14

18. A man had remaining in his library 340 books after having given away at one time $\frac{1}{8}$ of his books, and later $\frac{1}{7}$ of those then remaining, and finally selling $\frac{1}{6}$ of those not given away. How many had he at first?

19. What sum will a man have to his credit on Feb. 5, 1919, if he deposited \$640 in a bank at 4% on April 15, 1914?

20. A tank 9′ long, 8′ wide, and 7′ deep is filled with water. Find the weight of the water.

21. Find the freight charge on 1890 lb. of fresh fish at 13¢ per hundredweight.

22. Park & Tilford imported olive oil from Italy valued at 3460 lire. What was the value of the oil in our money?

23. A hardware dealer sold 2 doz. planes at $7.50; 3 doz. mortise locks at $3.40; 7 grindstones at $2.25; 2 doz. wrenches at $10.50. What was the amount of the bill?

24. A land speculator paid $5870 for a large chicken farm. He spent $2370 improving the buildings and the land. If he sold the farm for $9888, what per cent did he gain on his investment?

25. The triangular gable of a house has a 13-ft. base and a 10½-ft. altitude. Find the area of the triangle.

26. A boy purchased 3⅓ lb. of butter at 48¢, 3 doz. eggs at 40¢, 5 lb. prunes at 19¢, and 8 bars of soap at 6½¢. How much change should he have received if he gave a 5-dollar bill in payment?

27. An investor paid $8500 for a factory, spent $1125 repairing it, and then sold it for 22% above the entire cost. What did he receive for it?

28. The cost of food purchased for 12 hens for the six months from April 1 to October 1 was $1.48 per month. During that period the owner collected on an average 7 eggs a day. These eggs were sold at 48½¢ a doz. Allowing 30 days to the month, how much money was gained by keeping the hens?

29. What will it cost to fence a field 58 rd. 8¼ ft. long and 39 rd. wide, if the fence costs $3.25 per rod?

30. What will it cost to excavate a space 20 ft. long, 12 ft. wide, and 3 ft. 6 in. deep at $1.10 a cu. yd.?

II. APPLICATIONS OF PERCENTAGE

ORAL PROBLEMS

1. If an automobile costing \$2400 was sold at a loss of \$400, what was the per cent of loss?

2. A dealer bought piano lamps at \$3.20 apiece and sold them at a profit of $12\frac{1}{2}\%$. Tell the gain and the selling price.

3. An agent charged $2\frac{1}{2}\%$ for selling a shipment of fruit worth \$6200. How much did he receive?

4. What rate does an agent earn who charges \$70 for collecting a debt of \$1400?

5. Find the amount of the sale if an agent who gets a commission of 4%, receives a check for \$160 as his commission.

6. On a purchase of 6 shirts at \$1.30 each, a discount of 10% is given. What is the net price?

7. On a bill for plumbers' supplies amounting to \$2000, discounts of 10% and 5% are allowed. Find the net cost.

8. Which series of discounts is preferable on a purchase of \$200: discounts of 30% and 5%, or discounts of 5% and 30%?

9. Discounts of 40% and 10% are equal to what direct discount?

10. If a man receives a discount of 5% on his bill, reducing the total by \$8, what was the cost of the goods he purchased?

11. An importer received 7000 yd. of lace valued at 50¢ a yd. If the duty is 60% ad valorem, how much did he pay the government?

12. Find the specific duty on a shipment of $4\frac{1}{2}$ T. of maple syrup at 3¢ a lb.

WRITTEN PROBLEMS

1. A dealer buys a quantity of picture frames for $984.50. If the selling expenses amount to $210 and the goods are sold at a profit of 15%, what is his gain?

2. A piano player was sold for $18 less than cost, which was a loss of 6%. Find the cost of the instrument and the amount received for it.

3. A man sold 37½% of his business for $1500. At how much was the entire business valued?

Find:

4. 72½% of $2460 **6.** 5.2% of $460 **8.** 18.4% of $2600
5. 9¼% of 1120 **7.** 145% of 8200 **9.** 1.47% of 12,000

10. A boy sold a pair of skates for $.75 more than he paid for them, thereby gaining 15%. How much did he receive?

11. A house and lot cost $5000. If the expenses amount to $280 per year, what rent per month must the owner receive in order to make 8% on his investment?

12. An agent sold $4000 worth of machinery on a commission of 3½%. He paid $75.40 freight charges and $18.10 cartage. What were the net proceeds of the sale?

13. After deducting a commission of 5% for his work an agent sends $826.50 to his principal. What was the amount of his sales? What was his commission?

14. If a salesman received $116.25 in one month as commission on sales amounting to $4750, what was his rate of commission?

15. I sold a consignment of 1800 bbl. of flour at $6.80 a bbl. If I paid $65 for storage and $23 for cartage, how much ought I to remit after deducting 1½% commission?

16. A broker purchased for an importer 46,000 lb. of cocoa at 8½¢. Find his brokerage at ½%.

17. An agent sold 280 crates of tomatoes, and after taking out his commission of $2\frac{1}{2}\%$, sent his principal \$436.80. At what price per crate were the tomatoes sold?

18. How much more does a table cost that is marked \$49.50, the discount being 20%, than a table marked \$35.25, but without discount?

19. A bill of plumbing supplies totaling \$496 at list prices was discounted 20% and 10%. What was the net price?

20. How much less does a dealer pay for 3400 lb. of Manila rope listed at $16\frac{1}{2}¢$ a lb., if he pays in 10 days with 4% off, instead of in a month with 3% off?

21. What is the net cost of 4 chairs @ \$3.75, 2 rockers @ \$11.20, and 2 tables at \$22.50; discounts 20% and 5%?

22. Find the difference, in a bill of \$1220, between a direct discount of 40% and successive discounts of 30% and 10%.

23. An automobile was bought for \$3600 less $12\frac{1}{2}\%$, 10%, and 5%. What was the net price?

24. A factory worth \$75,500 is assessed for 40% of its value at $1\frac{1}{2}\%$. What is the amount of the tax?

25. When the tax rate is \$1.49 per \$100, how much must be paid on a house assessed at \$12,200?

26. Find the tax rate in a town where property assessed at \$324,000 is taxed \$2106.

27. The assessed valuation of a school district is \$560,000; the amount to be raised is \$4760. What would be the amount of school tax on property valued at \$1200?

28. The tax rate of a city was lowered from \$2.08 per \$100 to \$1.87. How much was the tax reduction on property assessed at \$44,500?

29. The duty on woolen clothing is 35%. What is the duty on a suit of clothes costing \$42 in Glasgow?

30. If a dealer imports a rug costing \$430 in Smyrna, what price must he set on it to cover both the duty of 50% and a profit of 30%?

31. An importer receives a consignment of 175 pounds of perfumery valued in Paris at \$385. If the specific duty is 40¢ a pound and the ad valorem duty 60%, what total charges must be paid?

32. The duty on manufactured toys is 35%. In one month \$416,000 worth of toys were imported. How much duty was paid on these?

33. What is the duty on 320 boxes of grapefruit, each box containing 36 lb., if the rate is $\frac{1}{2}$¢ a lb.?

34. Find the duty on 48 rolls of floor matting, each 9′ wide and 60′ long, if the rate is $2\frac{1}{2}$¢ per sq. yd.

35. A department store ordered 66 doz. pairs of gloves at \$1.80 a pair. If the duty on these is \$2.70 a dozen pairs, figure the total amount paid to the government.

36. Find the annual premium on a house insured for \$9400, if the rate of insurance is \$.85 per \$100.

37. A man takes out an insurance policy on his life for \$4000. If the rate is \$18.20 per thousand, what is his annual premium?

38. If a dealer insures the contents of a warehouse for \$18,400, what premium must he pay at \$2.20?

39. If \$74.40 is paid as premium on a policy for \$6200, what is the rate of insurance?

40. The face of a policy is \$8700. The rate is \$2.40. What is the premium?

41. A vessel is insured for \$125,000 and its cargo for \$310,000. What is the total premium at \$1.35?

42. If \$144 is paid as premium on a policy for \$9600, what is the rate of insurance?

III. MONEY AND INTEREST

ORAL REVIEW EXERCISE

What interest must be paid for the use of:

1. \$1000 at 6% for 2 yr. 4 mo.?
2. \$800 at 3% for $1\frac{1}{2}$ yr.?
3. \$2000 at $2\frac{1}{2}$% for 2 yr.?

Find the bank discount on the following notes at 6%:

4. \$1400, 30 da.
5. \$1600, 90 da.
6. \$1500, 60 da.
7. \$640, 120 da.
8. \$1800, 60 da.
9. \$2000, 120 da.

Find the interest on the following notes and tell the amount on which the bank discount would be based:

10. \$2000, 2 mo., 4%
11. \$600, 3 mo., 5%
12. \$3200, 3 mo., 3%
13. \$1600, 8 mo., 6%

WRITTEN REVIEW EXERCISE

1. A business man borrowed \$4800 for 1 yr. 6 mo. 20 da. at 6%. What was the interest ? The amount?

2. Find the proceeds of a 60-da. note for \$1500 discounted at 6% on the day it was made.

3. A 90-day note for \$2000 with interest at 4% given on Sept. 15, was discounted at a bank on Nov. 4 at 5%. What were the proceeds?

4. A man loaned a sum of money for 1 yr. 6 mo. at 3% and received \$36 interest. How much money was loaned?

5. At what rate of interest will \$400 yield an interest of \$20 in 1 yr. 3 mo.?

6. How long must \$600 be placed at interest at 4% to yield \$30 interest?

The Use of Interest Tables. Many bankers and business men use a table like the following in determining the number of days between two dates:

TABLE OF DAYS INTERVENING BETWEEN DATES

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Jan.	365	31	59	90	120	151	181	212	243	273	304	334
Feb.	334	365	28	59	89	120	150	181	212	242	273	303
Mar.	306	337	365	31	61	92	122	153	184	214	245	275
Apr.	275	306	334	365	30	61	91	122	153	183	214	244
May	245	276	304	335	365	31	61	92	123	153	184	214
June	214	245	273	304	333	365	30	61	92	122	153	183
July	184	215	243	274	304	335	365	31	62	92	123	153
Aug.	153	184	212	243	273	304	334	365	31	61	92	122
Sept.	122	153	181	212	242	273	303	334	365	30	61	91
Oct.	92	123	151	182	212	243	273	304	335	365	31	61
Nov.	61	92	120	151	181	212	242	273	304	334	365	30
Dec.	31	62	90	121	151	182	212	243	274	304	335	365

In Leap Year, when Feb. 29 intervenes, add one day.

If we wish to find the number of days from Apr. 15 to Aug. 29, we start at April in the left-hand column and follow across the line to the August column. We find 122 days as the number from Apr. 15 to Aug. 15; as we seek the number to Aug. 29, we add 14 to 122, and find 136 days as the difference.

To find the days from Dec. 26 to May 8, we find the days from Dec. 26 to May 26, or 151 days, and then subtract 18 days, which leaves 133 days as the difference.

By using the table, find the number of days from:

1. Mar. 24 to Sept. 24
2. July 26 to Apr. 30
3. Oct. 8 to June 15
4. May 25 to Mar. 10

Find the interest at 6% on:

5. $1460 from June 5 to Oct. 13
6. $450.50 from Jan. 10 to May 10
7. $228.10 from July 9 to Dec. 16

SIMPLE INTEREST TABLE

This table is based on a year of 360 da. and a 6% rate

Years	$1000	$2000	$3000	$4000	$5000	$6000	$7000	$8000	$9000
1	60	120	180	240	300	360	420	480	540
2	120	240	360	480	600	720	840	960	1080
3	180	360	540	720	900	1080	1260	1440	1620
4	240	480	720	960	1200	1440	1680	1920	2160
5	300	600	900	1200	1500	1800	2100	2400	2700
6	360	720	1080	1440	1800	2160	2520	2880	3240
..	...	...	...	....	..	...	...	...	...
Months	**$1000**	**$2000**	**$3000**	**$4000**	**$5000**	**$6000**	**$7000**	**$8000**	**$9000**
1	5	10	15	20	25	30	35	40	45
2	10	20	30	40	50	60	70	80	90
3	15	30	45	60	75	90	105	120	135
4	20	40	60	80	100	120	140	160	180
5	25	50	75	100	125	150	175	200	225
6	30	60	90	120	150	180	210	240	270
7	35	70	105	140	175	210	245	280	315
8	40	80	120	160	200	240	280	320	360
..	...	...	...	...	...	...	...	...	...
Days	**$1000**	**$2000**	**$3000**	**$4000**	**$5000**	**$6000**	**$7000**	**$8000**	**$9000**
1	.167	.333	.50	.667	.833	1.00	1.167	1.333	1.50
2	.333	.667	1.00	1.333	1.667	2.00	2.333	2.667	3.00
3	.500	1.000	1.50	2.000	2.500	3.00	3.500	4.000	4.50
4	.667	1.333	2.00	2.667	3.333	4.00	4.667	5.333	6.00
5	.833	1.667	2.50	3.333	4.167	5.00	5.833	6.667	7.50
6	1.000	2.000	3.00	4.000	5.000	6.00	7.000	8.000	9.00
7	1.167	2.333	3.50	4.667	5.833	7.00	8.167	9.333	10.50
8	1.333	2.667	4.00	5.333	6.667	8.00	9.333	10.667	12.00
9	1.500	3.000	4.50	6.000	7.500	9.00	10.500	12.000	13.50
10	1.667	3.333	5.00	6.667	8.333	10.00	11.667	13.333	15.00
11	1.833	3.667	5.50	7.333	9.167	11.00	12.833	14.667	16.50
12	2.000	4.000	6.00	8.000	10.000	12.00	14.000	16.000	18.00
13	2.167	4.333	6.50	8.667	10.833	13.00	15.167	17.333	19.50
14	2.333	4.667	7.00	9.333	11.667	14.00	16.333	18.667	21.00
15	2.500	5.000	7.50	10.000	12.500	15.00	17.500	20.000	22.50
16	2.667	5.333	8.00	10.667	13.333	16.00	18.667	21.333	24.00
17	2.833	5.667	8.50	11.333	14.167	17.00	19.833	22.667	25.50
18	3.000	6.000	9.00	12.000	15.000	18.00	21.000	24.000	27.00
19	3.167	6.333	9.50	12.667	15.833	19.00	22.167	25.333	28.50
20	3.333	6.667	10.00	13.333	16.667	20.00	23.333	26.667	30.00
..	...	...	...	...	...	...	...	...	...

Much time is saved in banks and offices in computing interest by using an interest table like the one on the preceding page, based on a year of 360 days and a rate of 6%.

WRITTEN EXERCISE

1. Find, from the table opposite, the interest on \$3500 for 1 yr. 3 mo. 12 da. at 6%:

Interest on \$1000 for 1 yr.	= \$ 60
Interest on \$1000 for 3 mo.	= 15
Interest on \$1000 for 12 da.	= 2
Interest on \$1000 for 1 yr. 3 mo. 12 da.	= \$ 77
	$3\frac{1}{2}$
Interest on \$3500 for 1 yr. 3 mo. 12 da.	= \$269.50

Using the tables, find the interest on the following:

2. \$9000 for 13 da. at 6%
3. \$1200 for 21 da. at 6%
4. \$2700 for 5 yr. at 6%
5. \$500 for 3 yr. 18 da. at 6%
6. \$200 for 1 yr. 6 mo. at 6%
7. \$1800 for 6 mo. 9 da. at 2%
8. \$700 for 5 mo. 5 da. at 6%
9. \$3000 for 4 mo. 9 da. at 6%
10. \$8500 for 8 mo. 9 da. at 6%
11. \$12,000 for 1 mo. 3 da. at 6%
12. \$1500 from Mar. 4 to July 2 at 6%
13. \$2500 from Jan. 4 to Apr. 4 at 6%
14. \$4000 from Oct. 28 to Apr. 26 at 3%
15. \$3400 from Dec. 5 to Aug. 2 at 2%
16. \$6000 from Feb. 14 to Aug. 13 at 4%
17. \$5500 from Nov. 3 to Mar. 3 at 6%

COMPOUND INTEREST

A Savings Bank Account. Savings banks generally pay interest on deposits semiannually, at the end of specified six months; or *quarterly*, at the end of specified three months. When this interest is not drawn out by the depositor, the bank uses it for investment purposes together with the original principal so that at the next interest-paying date it is usual for the bank to pay interest on the principal deposit and also on the accumulated interest that has been credited to one's account. This interest earned on interest due but not yet paid is called **compound interest.**

Principal	\$1500
Rate for ½ yr.	.02
Int. for first ½ yr.	\$30
	1500
Amt. for first ½ yr.	\$1530
	.02
Int. for second ½ yr.	\$30.60
	1530
Amt. for 1 yr.	\$1560.60
	.02
Int. for third ½ yr.	\$31.21
	1560.60
Amt. for 1½ yr.	\$1591.81
	1500
Int. for 1½ yr.	\$ 91.81

For example: Frederick D. Lewis deposited \$1500 in the United States Savings Bank at 4% interest, the interest to be compounded semiannually. How much was the amount after 1½ years? Mr. Lewis instead of drawing out the interest kept it in the bank. At the end of the specified first six months the bank entered the \$30 interest in his book, as if a new deposit at the 4% interest. This practice was continued through all the semiannual periods. The amount was accordingly \$1591.81. How much more than simple interest was this \$91.81 compound interest?

Drawing Interest. Savings banks differ as to the time from which money deposited begins to earn interest. Some allow interest from the first day of each month; some from the first day of each half year, January 1 and July 1; some from the first of each quarter, January, April, July, and October. Find out the rate of interest paid by the savings bank nearest your school. When does it compound interest? What are the interest dates?

The period of time for which interest is compounded is called the **interest period** or the **interest term.** This is not always the same as the number of years.

As a rule savings banks pay interest only on the number of dollars deposited and not on the cents. This is done to avoid the labor of computation.

WRITTEN EXERCISE

Find the amount of the principal and interest if the interest is compounded annually:

1. \$2000, 2 yr., 3%
2. \$2220, 3 yr., 4%
3. \$5000, 4 yr., 4%
4. \$4000, 5 yr., 3%
5. \$6500, 3 yr., 3%
6. \$4800, 4 yr., 4%
7. \$7000, 2 yr., 4%
8. \$9100, 3 yr., 3%

9. Find the difference between the interest earned by \$3000 left in one bank for 3 yr. at 4% simple interest, and that earned by the same amount left in another bank for a like time at 4% interest compounded annually.

These sums are deposited in banks which compound the interest semiannually. Find the amount:

10. \$300, 2 yr., 3%
11. \$900, 3 yr., 5%
12. \$1200, 3 yr., 4%
13. \$1500, 3 yr., 3%
14. \$4000, 2 yr., 6%
15. \$2400, 3 yr., 4%

The Use of the Compound Interest Table. The clerks in savings banks and business houses generally use a special table in computing compound interest. This table shows to how much \$1 will amount at different rates of interest for different periods.

1. By using the table opposite, find the amount of \$800 for 8 yr. at 6%, interest compounded annually:

By the table, the amount for \$1 for 8 yr. at 6% compound interest is \$1.593848. Hence the amount of \$800 for the same time at the same rate is $800 \times \$1.593848 = \$1275.08$.

To find the amount of a specified principal for a certain number of years at a given rate, interest compounded annually:

(*a*) *From the table take the amount of* \$1 *at the specified rate for the specified number of years.*

(*b*) *Multiply this amount by the principal.*

2. From the table opposite, find the amount of \$700 for 3 yr. at 5%, interest compounded semiannually.

Since the interest at 5% per annum is compounded semiannually, there are, in the 3 years, 6 of the interest periods, and the rate for each period is $2\frac{1}{2}\%$.

The table gives the amount of \$1 at $2\frac{1}{2}\%$ for 6 periods as \$1.159693. For \$700 the amount is $700 \times \$1.159693 = \$811.79$.

To find the amount of a specified principal for a certain number of years at a given rate, interest compounded semiannually:

(*a*) *From the table take the amount of* \$1 *for one half the rate for twice the time.*

(*b*) *Multiply this amount by the principal.*

NOTE.—The compound interest table is to be used only for whole interest periods; namely, for years if the interest is compounded annually; for half years, if compounded semiannually, etc. If the specified time is not exactly divisible by the specified interest period, determine the greatest number of

whole periods contained in the specified time and take from the table the amount of the principal for that number of periods; then on this amount compute simple interest for the balance of the time.

A COMPOUND INTEREST TABLE

Amount of $1, *at the given rates, compound interest,* 1 *to* 15 *years*

PERIODS	1 %	1¼ %	2 %	2½ %	3 %
1	1.010000	1.015000	1.020000	1.025000	1.030000
2	1.020100	1.030225	1.040400	1.050625	1.060900
3	1.030301	1.045678	1.061208	1.076891	1.092727
4	1.040604	1.061364	1.082432	1.103813	1.125509
5	1.051010	1.077284	1.104081	1.131408	1.159274
6	1.061520	1.093443	1.126162	1.159693	1.194052
7	1.072135	1.109845	1.148686	1.188686	1.229874
8	1.082857	1.126493	1.171660	1.218403	1.266770
9	1.093685	1.143390	1.195093	1.248863	1.304773
10	1.104622	1.160541	1.218994	1.280085	1.343916
11	1.115668	1.177949	1.243374	1.312087	1.384234
12	1.126825	1.195618	1.268242	1.344889	1.425761
13	1.138093	1.213552	1.293607	1.378511	1.468534
14	1.149474	1.231756	1.319479	1.412974	1.512590
15	1.160969	1.250232	1.345868	1.448298	1.557967

PERIODS	3½ %	4 %	4½ %	5 %	6 %
1	1.035000	1.040000	1.045000	1.050000	1.060000
2	1.071225	1.081600	1.092025	1.102500	1.123600
3	1.108718	1.124864	1.141166	1.157625	1.191016
4	1.147523	1.169859	1.192518	1.215506	1.262477
5	1.187686	1.216653	1.246181	1.276281	1.338226
6	1.229255	1.265319	1.302260	1.340096	1.418519
7	1.272279	1.315932	1.360861	1.407100	1.503630
8	1.316809	1.368569	1.422100	1.477455	1.593848
9	1.362900	1.423312	1.486095	1.551328	1.689479
10	1.410600	1.480244	1.552969	1.628895	1.790848
11	1.459970	1.539454	1.622853	1.710339	1.898299
12	1.511069	1.601032	1.695881	1.795856	2.012197
13	1.563956	1.665074	1.772196	1.885649	2.132928
14	1.618695	1.731676	1.851945	1.979931	2.260904
15	1.675348	1.800944	1.935282	2.078928	2.396558

WRITTEN EXERCISE

By using the table, find the amount if the interest is compounded annually:

1. \$800, 7 yr., 5%
2. \$870, 14 yr., 1½%
3. \$2000, 5 yr., 3½%
4. \$600, 12 yr. 3 mo., 3½%
5. \$3200, 4 yr. 6 mo., 4½%
6. \$450.50, 5 yr. 6 mo., 2½%

Find the amount if the interest is compounded semiannually:

7. \$400, 4 yr., 3%
8. \$900, 3 yr., 4%
9. \$1600, 5 yr., 3%
10. \$100, 5 yr., 5%
11. \$500, 2½ yr., 4%
12. \$800, 4 yr., 6 mo., 2%

WRITTEN PROBLEMS

1. A man with \$800 to invest may lend it on a note at 5% interest, or deposit it in a bank paying 4% interest, compounded semiannually. At the end of a year, which investment would pay him more? How much more?

2. What is the compound interest on \$3000 deposited in a savings bank for 6 years at 3½%, if the interest is compounded annually?

3. On July 5, 1916, a man deposited \$350 in a savings bank. If the bank pays interest at 4% semiannually, what will be paid on Jan. 5, 1919?

4. Find the compound interest on \$1800 for 2 yr. at 4%, interest compounded semiannually.

5. What is the difference between the amount of \$500 for 8 years at 4% compound interest, and at 4% interest compounded semiannually?

6. What is the compound interest on \$9876 for 7 yr. 6 mo. at 5%, compounded semiannually?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Multiply by 10;	*by* 100;	*Divide by* 10;	*by* 100;	*by* 1000:
1.	.7	56.	40.7	34.1	873.
2.	2.3	793.	1.32	8.7	24.6
3.	.081	.0078	547.	231.	24.17
4.	3.43	42.851	.83	9.7	5678.3
5.	246.7	2.4345	.125	39.1	73497.

	Find the interest on \$1000 *for:*				*Multiply:*
6.	2 yr. 6 %	4 mo. 3 %	4 mo. 6 %	3 mo. 4%	$7\times\frac{4}{8}$
7.	6 mo. 4 %	2 yr. 5 %	8 mo. 4 %	1 yr. $2\frac{1}{2}$%	$6\times\frac{4}{15}$
8.	2 mo. 3 %	10 mo. 6 %	3 yr. $3\frac{1}{2}$%	2 yr. $4\frac{1}{2}$%	$14\times\frac{3}{5}$
9.	3 yr. 5 %	2 yr. $3\frac{1}{2}$%	2 yr. $2\frac{1}{2}$%	1 yr. $5\frac{1}{2}$%	$12\times\frac{4}{8}$
10.	90 da. 6 %	$1\frac{1}{2}$ yr. 2 %	$3\frac{1}{2}$ yr. 1 %	60 da. 4%	$16\times\frac{2}{7}$
11.	4 yr. $2\frac{1}{2}$%	1 yr. $3\frac{1}{2}$%	5 mo. 6 %	2 mo. 6%	$15\times\frac{3}{10}$

	Read:			*State results:*	
12.	XXIX	XXVII	MLXIV	\$27.36 − \$8.19	$\frac{4}{5}\div\frac{2}{5}$
13.	MCDXX	LXVI	MDCC	\$14.23 − \$7.16	$\frac{5}{8}\div\frac{3}{8}$
14.	XXXIV	MDCIX	MDCXX	\$19.78 − \$6.45	$\frac{5}{6}\div\frac{2}{3}$
15.	MCCXL	XLIV	XCIX	\$11.76 − \$5.23	$\frac{6}{7}\div\frac{3}{14}$
16.	XLIV	CCXIX	CDIV	\$22.43 − \$4.12	$\frac{5}{9}\div\frac{7}{18}$

	Tell the answers:				
17.	\$2.24 + \$.48	\$18.24 + \$1.02	\$37.16 − \$11.08	$1\frac{1}{4}+\frac{1}{3}$	$\frac{4}{7}\times\frac{14}{28}$
18.	9.93 + .52	11.49 + 3.06	45.02 − 17.05	$1\frac{3}{7}+1\frac{5}{7}$	$\frac{5}{8}\times\frac{16}{30}$
19.	8.87 + .63	12.60 + 7.10	54.46 − 10.04	$3\frac{2}{3}+\frac{1}{3}$	$\frac{2}{5}\times\frac{18}{20}$
20.	4.25 + .71	17.23 + 4.08	37.19 − 11.02	$1\frac{1}{8}+\frac{1}{7}$	$\frac{3}{5}\times\frac{20}{21}$
21.	3.46 + .18	19.85 + 3.46	22.14 − 14.14	$\frac{8}{7}+\frac{8}{7}$	$\frac{5}{6}\times\frac{24}{35}$
22.	2.25 + .96	11.14 + 5.86	56.73 − 10.24	$1\frac{3}{5}-\frac{2}{5}$	$\frac{2}{3}\times\frac{9}{70}$
23.	4.16 + .89	24.16 + 4.13	84.97 − 11.52	$1\frac{4}{5}-\frac{1}{10}$	$\frac{3}{7}\times\frac{28}{30}$
24.	7.23 + .75	18.79 + 2.25	23.48 − 12.13	$1\frac{1}{2}-\frac{5}{8}$	$\frac{2}{10}\times\frac{40}{90}$
25.	8.46 + .43	14.23 + 7.16	47.56 − 13.27	$1\frac{3}{4}-\frac{1}{2}$	$\frac{1}{4}\times\frac{24}{32}$
26.	3.24 + .68	10.08 + 8.04	39.14 − 14.02	$1\frac{1}{2}-\frac{3}{4}$	$\frac{2}{25}\times\frac{50}{90}$

GENERAL WRITTEN PROBLEMS

1. A storekeeper bought notebooks at \$1.20 a doz. and sold them at 15¢ apiece. What per cent did he gain?

2. A note for \$600 dated Dec. 2, 1917, is discounted at a bank Dec. 27, 1917, at 6%. Find the bank discount and the net proceeds.

3. A dealer offers an automobile for \$2500, subject to discounts of 20% and 10%. Another dealer offers the same make of machine for \$2500, subject to discounts of 15% and 15%. Which is the better offer, and how much better?

4. How much tax must a man pay who owns a house assessed at \$3900, a store assessed at \$8700, and a factory assessed at \$24,500, if the tax rate is \$2.30 per thousand?

5. On Feb. 20, 1917, a business man deposited \$1564 in a savings bank. On Aug. 1, 1917, he deposited \$768 in the same bank. What amount may he draw out on Jan. 30, 1920, if the bank pays $3\frac{1}{2}$% interest, compounded semiannually from the date of deposit?

6. A man purchased a house for \$8000. The first year the expenses for repairs were \$225, for taxes \$150, for insurance \$20. If the house was rented for \$90 a month, what per cent did he gain on his investment that year?

7. On Mar. 15, 1917, a man deposited \$600 in a savings bank paying 4% interest, compounded semiannually. What amount was due him on Sept. 15, 1918?

8. A dwelling worth \$24,800 is insured for $\frac{3}{4}$ of its value at \$1.25. What is the amount of the premium?

9. What is the net cost of machinery listed at \$920 with discounts of 10%, 10%, and 10%?

10. What is the compound interest on \$800 for 3 years at 4%, if the interest is compounded semiannually?

11. Find the commission at $3\frac{1}{2}\%$ on 87 tubs of butter, each containing 50 lb., sold at 27¢ a pound.

12. Refrigerators listed at \$24, a dealer bought at discounts of 25% and 10%. If he sold the refrigerators at the list price, what per cent did he gain?

13. Not caring to put all his money in one bank, a man with \$2000 deposits \$1000 in a bank paying 4% simple interest, and \$1000 in a bank paying 4% interest compounded semiannually. At the end of four years, how much more can he draw from the second bank than from the first?

14. A dealer bought a 36,000 lb. carload of wheat at \$.72 a bu. and stored it in a grain elevator. He then shipped it east and paid $2\frac{1}{2}$¢ a bu. for storing and handling. The freight charge was $17\frac{1}{2}$¢ per cwt. How much did the carload cost the dealer on its arrival in the east?

(1 bu. of wheat = 60 lb.)

15. A steel freight car with a capacity of 110,000 lb. is loaded to 90% of its capacity with wheat. How many bu. does it contain?

16. A father deposits \$1200 for his son on his fifteenth birthday. The bank pays 4% interest, compounded semiannually. If he makes no changes in the amount on deposit, what sum will the son have to his credit on his twenty-first birthday?

17. In 1840 the highest rate of speed made in crossing the Atlantic was 9.25 knots; in 1917 it was 27.04 knots. Find the percentage of increase.

18. The premium on a factory insured for \$18,500 is \$222. What is the insurance rate?

19. What is the amount of \$2000 for 2 yr., if the interest at 4% is compounded quarterly?

20. What will $29\frac{3}{4}$ qt. honey cost at $76\frac{1}{4}$¢ a qt.?

IV. MEASUREMENT

REVIEW OF RECTANGLES AND TRIANGLES

Explain how the area of a rectangle is found. What is the dotted line on the parallelogram called? How is the area of a parallelogram found?

If the area of a rectangle or a parallelogram and one dimension are given, how is the other dimension found?

Point out the altitude of the triangle. What is the relation between the area of the triangle and that of the rectangle having the same base and altitude? Explain how the area of the triangle is found.

ORAL EXERCISE

Find the areas of these rectangles:

1. 8 ft. by 9 ft.
2. 4 yd. by 7 ft.
3. $5\frac{1}{2}'$ by $2'$
4. $4'$ by $9''$
5. $2'\ 4'' \times 3'$
6. 12 ft. $\times 2\frac{1}{2}$ ft.

Find the areas of triangles with base and altitude as follows:

7. 6 in., 5 in.
8. 2 ft., 4 in.
9. $16'$, $5'$
10. $20'$, $6''$
11. $2'\ 6''$, $4'$
12. 10 ft., 6 ft.

WRITTEN EXERCISE

1. A drawing board is $21\frac{1}{4}$ in. long and 16 in. wide. How many sq. in. of oak tag will be needed to cover one side?

2. A building lot containing 4500 sq. ft. is 25 ft. wide. How long is it? What is its perimeter?

3. A water tank is 24′ long and 9′ wide. What will be the cost of cementing the bottom at \$1.12½ a sq. yd.?

4. A street a quarter of a mile long, whose roadway is 40 ft. wide, is paved with Belgian blocks. If 45 blocks are required to pave one sq. yd., how many blocks will be required to pave the entire roadway?

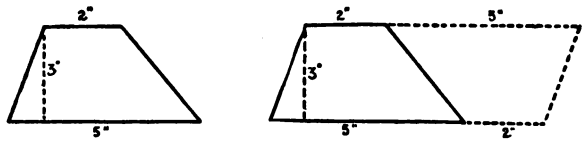
5. The base of a triangular flower bed is 48 ft. If the altitude is ½ the base, what is the area?

6. The area of a triangular court is 616 sq. ft. The base is 28 ft. Find the altitude.

7. How many square feet of goods will be needed to make a triangular school pennant with a base of 2 ft. 8 in. and an altitude of 8 in.?

8. How many sq. ft. in a triangular advertising sign whose base is 26 ft. and height 14 ft.?

Area of a Trapezoid. A four-sided figure having one pair of opposite sides parallel is called a **trapezoid.**



If we extend the parallel sides of the left-hand trapezoid, as shown in the right-hand diagram, we secure two trapezoids exactly alike, making a parallelogram. The area of the trapezoid is therefore ½ the area of the parallelogram. Since the area of the parallelogram = the base × the altitude, the area of the trapezoid = ½(base × altitude). But the base of the parallelogram is the sum of the two parallel sides of the original trapezoid, so that:

The area of a trapezoid is equal to one half the product of the altitude by the sum of the parallel sides.

WRITTEN EXERCISE

Find the area of each of the following trapezoids:

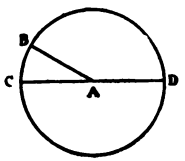
	BASE	PARALLEL SIDE	ALTITUDE
1.	18 ft.	14 ft.	10 ft.
2.	26 in.	20 in.	4 in.
3.	48 yd.	28 yd.	9 yd.
4.	$3\frac{1}{2}'$	$2\frac{1}{2}'$	$\frac{1}{2}'$

5. A piece of copper is a trapezoid with its parallel sides 20 in. and 28 in. long and an altitude of 24 in. At 20¢ a sq. ft., what is the value of the piece?

6. The parallel sides of a lot measure 72 ft. and 35 ft. If the altitude is 90 ft., what is the area of the lot?

7. Find the number of sq. ft. of wood needed for the two sides of a magazine stand 48″ high, each side being 14″ wide at the base, and tapering to a width of 10″ at the top.

The Circle: Relation of Diameter to Circumference. A plane surface bounded by a curved line every point of which is equally distant from a point within called the center, is a **circle.**



The distance from the center to the curve is the radius. How many radii are shown here?

The bounding line around a circle is called the **circumference.**

Any straight line through the center terminating in the circumference, like CD, is a **diameter.**

Any part of a circumference, like BC, is called an **arc.** A figure bounded by two radii and one arc, like BAC, is a **sector.**

With the aid of a tape measure find the distance around a hoop, a pail, or a phonograph record. Divide this distance by the diameter of the object. Repeat with circles cut from cardboard and rolled along the tape.

It will be found that in each circle *the circumference is about* $3\frac{1}{7}$ (*or, more nearly,* 3.1416) *times the diameter.* The Greek letter π (pī), the initial letter of the Greek word corresponding to *circumference,* is used to denote the relation between circumference and diameter.

In working the examples in this book, unless otherwise directed, consider that $\pi = 3\frac{1}{7}$, or $\frac{22}{7}$.

WRITTEN EXERCISE

Find the circumference of a circle if the diameter is:

1. 49 in.	**3.** 72 in.	**5.** 5 m.	**7.** 25 cm.
2. 21 ft.	**4.** 6.3 ft.	**6.** 1 ft. 2 in.	**8.** 15 rd.

Find the circumference of a circle if the radius is:

9. 84 cm.	**11.** 21 cm.	**13.** 66.5 ft.	**15.** 56 rd.
10. $17\frac{1}{2}$ yd.	**12.** 2 ft. 4 in.	**14.** $23\frac{1}{2}$ in.	**16.** 1.63 m.

Find the diameter of a circle if the circumference is:

17. 22 ft.	**19.** 7 ft. 4 in.	**21.** 24.2 yd.	**23.** 70 cm.
18. 33 in.	**20.** 3 ft. $2\frac{1}{2}$ in.	**22.** 5 ft. 6 in.	**24.** 50.6 m.

25. What is the circumference of a circle drawn with a compass whose points are 14 in. apart?

26. What is the diameter of a pipe with a circumference of 3.74 cm.?

Using 3.1416 *instead of* $3\frac{1}{7}$, *find the circumference of a circle whose diameter is:*

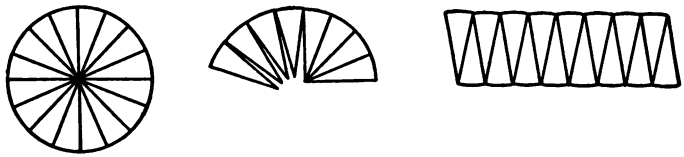
27. 16 ft.	**28.** 40 m.	**29.** 56 yd.	**30.** 50 rd.

Use 3.1416 *for* π*:*

31. A bicycle wheel is 2 ft. 3 in. in diameter. How far will the bicycle have gone when the wheel has made 200 rotations?

32. The diameter of the bullet in an army rifle is .805 mm. What is the circumference of the bullet?

Area of a Circle. We now wish to find the area of the surface enclosed by the circle. Using a sheet of paper, we may draw and then cut out a circle. This circle we may mark off into sixteenths by means of diameters. By cutting the circle in two along the horizontal diameter, we shall obtain two semicircles each consisting of eight sectors.



Beginning at the center, we may now cut along each radius to a point almost touching the circumference. If we gently stretch out the circumference of the two semicircles to straight lines and dovetail the two sets of sectors into each other, we get a figure which is practically a parallelogram.

The base of this parallelogram is one half the circumference of the circle, while the altitude is the radius of the circle. Therefore the area of the circle is equal to the product of one half the circumference by the radius.

The abbreviation d will be used to denote diameter, and r to denote radius.

Since the circumference is equal to about $3\frac{1}{7}$ times the diameter, or πd, the area of the circle $= \frac{1}{2}\pi d \times r$. If we substitute 2 radii for diameter, the formula will read:

$$\text{Area of circle} = \tfrac{1}{2}\pi 2r \times r = \pi r \times r = \pi r^2.$$

To find the square of a number, multiply the number by itself.

$$4^2 = 4 \times 4 = 16 \qquad 12^2 = 12 \times 12 = 144$$

The area of a circle is equal to πr^2, or approximately $3\frac{1}{7}$ times the square of the radius.

WRITTEN EXERCISE

Find the area of a circle whose radius is:

1. 10 ft.	3. 6 ft.	5. 16 ft. 6 in.	7. 3.5 cm.
2. 21 mm.	4. $22\frac{1}{2}$ rd.	6. 12 ft. 6 in.	8. 2.8 dm.

9. A horse is tied to a post with a rope 40 feet long. What is the area of the largest circle over which he can graze?

10. The diameter of a circular table is 45 in. What is its area?

11. What is the area of a cross section of a copper rod which is .14 in. in diameter?

12. Find the area of a circular piece of tin with a radius of 1 ft. 9 in.

13. The diameter of a circular piece of metal is .875 in. What is the area of the disc?

14. A tank is 84 ft. in diameter. How many sq. ft. of cement will be needed to cover the bottom?

15. How much greater is the area of a 10-ft. circle than the area of a 9-ft. circle?

16. From a rectangular piece of cardboard 8″ by $10\frac{1}{2}$″, I desire to cut the largest possible circle. How many sq. in. of the cardboard will be wasted in cutting?

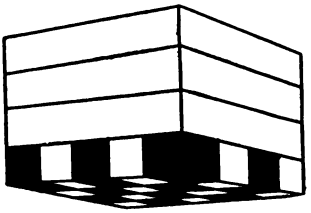
17. A garden hose will throw water 30 ft. How many sq. ft. of grass may be watered with it from one position?

Volume and Surface Area of a Rectangular Solid. How many dimensions has a surface?

Why is a cube called a rectangular solid? What are its three dimensions? How do we find the total surface area of a cube, a cake of ice, a block of stone?

The volume of a solid is the number of cubic units that it contains.

Suppose the pictured solid to be composed of one-inch cubes. How many inches long is the bottom layer? How many inches wide? How many cubic inches in the bottom layer? How many layers in the body? What is the cubical contents, or volume, of the body?

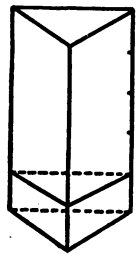


The volume of a rectangular solid is equal to the product of the area of the base by the altitude.

WRITTEN EXERCISE

1. Find the entire surface area of a cube 8 in. long.
2. What is the surface area of a box 2 ft. long, 3 ft. wide, and $1\frac{1}{2}$ ft. high?
3. A shipping case has the following inside measurements: length $4\frac{1}{2}$ ft., width $2\frac{1}{4}$ ft., depth $2\frac{1}{2}$ ft. Find the volume.
4. How many cubic yards of space in a cellar that measures 9 yd. by 8 yd. by 4 yd.?
5. How many cubic ft. of masonry in a stone wall 140 ft. long, 4 ft. high, and 18 in. thick?
6. At 80¢ a cu. yd. find the cost of excavating a foundation space $2\frac{1}{2}$ ft. wide, $2\frac{1}{4}$ ft. deep, and 81 ft. long.
7. A packing box is 30 in. long, 16 in. wide, and $8\frac{1}{2}$ in. deep. Determine its volume in cubic inches.
8. What is the entire surface area of a block of mahogany 3 in. by 2 in. by 8 in.?
9. How many cu. ft. of water in a tank 50 ft. long, 28 ft. wide, and $4\frac{1}{2}$ ft. deep?
10. There are 231 cu. in. in a gallon. How many gal. of gasoline will a tank hold that is 8 ft. long, 2 ft. 4 in. wide, and 2 ft. 4 in. deep?

Volume of a Prism. A prism is a solid whose faces are parallelograms and whose upper and lower bases are equal and parallel to each other. The shape of the base gives the name to the prism; as rectangular, square, triangular, hexagonal, etc.



In this *triangular* prism let the area of the base be 5 sq. in. In the bottom layer one inch high we then have 5 cu. in. Since there are 5 in. in the altitude of the prism, the volume must be 25 cu. in.

The volume of a prism is equal to the product of the area of the base by the altitude.

ORAL EXERCISE

Find the volume of each of these prisms:

	BASE	ALTITUDE		BASE	ALTITUDE
1.	7 sq. in.	9 in.	6.	2400 sq. in.	$37\frac{1}{2}$ in.
2.	23 sq. in.	8 in.	7.	560 sq. ft.	$87\frac{1}{2}$ ft.
3.	420 sq. in.	$33\frac{1}{3}$ ft.	8.	420 sq. ft.	$83\frac{1}{3}$ ft.
4.	361 sq. in.	4 in.	9.	1000 sq. ft.	75 in.
5.	900 sq. in.	25 ft.	10.	1800 sq. ft.	$16\frac{2}{3}$ in.

WRITTEN EXERCISE

1. A concrete pillar, in the shape of a triangular prism, has a base $7\frac{1}{2}$ sq. ft. in area. If the height is 28 ft., find the volume.

Find the volume of each of the following prisms:

	BASE	ALTITUDE		BASE	ALTITUDE
2.	212 sq. in	74 in.	4.	17.24 sq. in.	3.35 in.
3.	86.4 sq. ft.	8.7 ft.	5.	25.25 sq. yd.	7.5 yd.

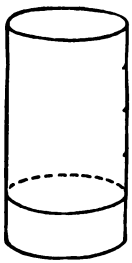
6. The volume of a hexagonal box is 246.75 cu. in. If the base is 52.5 sq. in., find the height of the box.

7. If twelve cu. ft. of air weighs one pound, find the weight of the air in a room 28′ long, 32′ wide, and 18′ high.

8. A square tank contains 8573.4 cu. ft. If the base is 476.3 sq. ft., how high is the tank?

9. The base of a prism contains 48.4 sq. in. and the altitude is 11.5 in. Find the volume.

Volume of a Cylinder. A cylinder is a solid, like a round rod, bounded by a uniformly curved surface and having circles parallel to each other for its two bases.



In the pictured cylinder the area of the base is 6 sq. in. Accordingly, in the bottom layer one inch high are 6 cu. in. Since there are 5 in. in the altitude of the cylinder, the volume must be 30 cu. in.

The volume of a cylinder is equal to the product of the area of the base by the altitude.

We have learned that the area of a circle is approximately $3\frac{1}{7}$ times the square of the radius. Therefore, the volume of a cylinder = approximately $3\frac{1}{7}$ × square of radius × altitude.

ORAL EXERCISE

Find the volume of each of the following cylinders:

	BASE	HEIGHT		BASE	HEIGHT
1.	24 sq. in.	7 in.	4.	27.63 sq. in	10 in.
2.	320 sq. ft.	$12\frac{1}{2}$ ft.	5.	640 sq. ft.	$37\frac{1}{2}$ ft.
3.	450 sq. in.	$66\frac{2}{3}$ in.	6.	150 sq. in.	$33\frac{1}{3}$ in.

WRITTEN EXERCISE

1. Compute the volume of a cylindrical tank whose base is 328 sq. ft. and whose height is 12.5 ft.

2. A cylinder 6 ft. 6 in. high has a base $18\frac{1}{2}$ sq. in. Find its volume.

3. A gas tank 48 ft. in height has a volume of 1448 cu. ft. Find the area of the base.

4. The altitude of a cylinder is 70 in. and the radius of the base is 10 in. Find the volume.

5. A water cart has a tank 12 ft. long and 4 ft. in diameter. If $7\frac{1}{2}$ gal. = 1 cu. ft., how many gal. will the tank hold?

6. The volume of a tank is 246 cu. ft. 864 cu. in. and the area of the base is 14 sq. ft. 72 sq. in. Estimate the height of the tank.

7. A water heater is $4\frac{1}{2}$ ft. high and 15 in. in diameter. How many gal. will it hold? ($7\frac{1}{2}$ gal. = 1 cu. ft.)

8. How many cu. ft. of difference is there between a 3-ft. cubical box, and a cylinder 18 in. in radius and 3 ft. high?

9. The circumference of a gas tank is 66 ft. and the height is 40 ft. Find the diameter, the area of the base, and the volume of the tank.

10. How many cu. ft. in an iron barrel whose diameter is 2 ft. and depth 3 ft.?

11. There are 231 cu. in. in a gal. A tank 18 in. in diameter and 5 ft. high will hold how many gal. of water?

Surfaces of Cylinders. The bases of a cylinder are circles and the rest of the surface is called the **convex surface.**

If we imagine the convex surface of the cylinder on page 42 unfolded as if it were a sheet of paper, the shape of the paper would be rectangular. Since the length of this rectangle would be the circumference of the base of the cylinder, we have:

The area of the convex surface of a cylinder is equal to the product of the altitude by the circumference of the base.

ORAL EXERCISE

Compute the area of the convex surface of each of the following cylinders:

	HEIGHT	CIRCUMFERENCE		HEIGHT	CIRCUMFERENCE
1.	12 ft.	120 ft.	3.	72 ft.	400 ft.
2.	$33\frac{1}{3}$ in.	60 in.	4.	$12\frac{1}{2}$ ft.	240 ft.

5. The circumference of a stovepipe is $16\frac{2}{3}$ in. and the length is 48 in. How many sq. in. of tin does it contain?

6. The distance around a tank is 45 ft. and the height is 200 ft. How many sq. ft. in the curved surface?

7. The distance around an asphalt roller is 22 ft. and the width is $5\frac{1}{2}$ ft. How many sq. ft. in the surface?

8. The circumference of a glass cylinder is $\frac{1}{3}$ yd. and the height is 30 in. How many sq. in. in the convex surface?

WRITTEN EXERCISE

1. A gas tank is 38 ft. high and 274.8 ft. in circumference. How many sq. ft. of paint will cover the curved surface?

2. Find the curved surface of a cylindrical pillar 82 ft. high and 12 ft. around.

3. The total surface of a cylinder includes, besides the convex portion, the areas of the circles forming the bases. Find the total surface of a cylinder 35 ft. long and 5 ft. in diameter.

4. An oil tank is 38 ft. high and 21 ft. in diameter. Find the cost of painting the curved surface at 45¢ a sq. yd.

5. How many sq. in. of surface are there in a 7-in. water pipe 24 ft. long?

6. At 4¢ a sq. ft., find the cost of painting a water pipe 14 in. in diameter and 96 ft. high.

7. What is the total surface of a steel cylinder 40 in. long and 5 in. in diameter?

THE METRIC SYSTEM

Bills, notes, orders, and specifications for contracts sent to the United States from foreign countries are now commonly expressed and computed in the metric system. In the Philippines and in Porto Rico the metric system is used exclusively, and nearly all other countries except Great Britain have adopted it. Besides these reasons, we must know the system if we are to understand the references to it in scientific periodicals and other literature.

The three basic units are:

The **meter** (m.), the unit of length, 39.37 in. (U. S. standard).

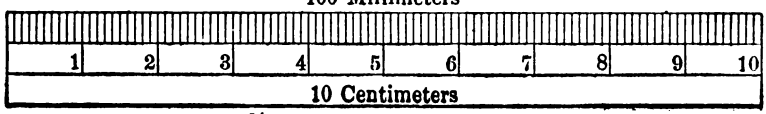
The **liter** (l.), the unit of capacity, the contents of a cube the side of which is .1 of a meter.

The **gram** (g.), the weight of a cubic centimeter of distilled water, about 15½ grains.

Metric Table of Length.

10 millimeters (mm.)	= 1 **centimeter**	(cm.)	= .01 of a meter
10 centimeters	= 1 decimeter	(dm.)	= .1 of a meter
10 decimeters	= 1 **meter**	(m.)	
10 meters	= 1 dekameter	(Dm.)	
10 dekameters	= 1 hektometer	(Hm.)	= 100 meters
10 hektometers	= 1 **kilometer**	(Km.)	= 1000 meters
10 kilometers	= 1 myriameter	(Mm.)	= 10,000 meters

The **millimeter** is .03937 in., which is nearly .04, or $\frac{1}{25}$, of an in.; accordingly, the **centimeter** is nearly .4, or $\frac{2}{5}$, of an in. The **meter** is about 1 yd. 3 in., or $3\frac{1}{4}$ ft. The **kilometer** approximates 3280.8 ft., or $\frac{5}{8}$ mi.



⅒ Meter, or 1 Decimeter

The Uses of the Prefixes. Four of the seven prefixes used in the metric system denote that *multiples of the unit* are to be taken:

deka-	means	10	=	10 meters
hekto-	means	100	=	100 liters
kilo-	means	1000	=	1000 grams
myria-	means	10,000	=	10,000 meters

Three of the prefixes are used as *divisors of the unit:*

deci-	means	.1	=	.1 of a meter
centi-	means	.01	=	.01 of a meter
milli-	means	.001	=	.001 of a gram

The decimal relation of the units makes most of the multiplications and divisions in the metric system a mere matter of moving the decimal point:

Km.	Hm.	Dm.	m.		dm	cm.	mm.
1	0	0	0	•	0	0	1

ORAL EXERCISE

1. How many m. in 25 Km.? 4.41 Dm.? .007 Km.? .35 Km.?
2. How many cm. in 1 m.? 3.42 mm.? 23.3 m.? 4 Km.?
3. How many mm. in .07 m.? 4.9 cm.? 1.1 m.? 3 Km.?
4. Change to Km.: 424.1 m.; 970 Hm.; 3000 cm.; 975 Dm.

State approximate equivalents:

5. 10 mm. 6. 30 m. 7. 200 Km. 8. 8 dm. 9. 20 cm.
10. A rope is 4.21 m. long. How many cm. long is it?

WRITTEN PROBLEMS

1. The distance between two points is 420 Km. What is the distance in miles?
2. Which is the wider and by how much: the base of a 42-cm. cannon, or the base of a 75-mm. gun?

3. How many m. of ribbon will be needed to make 45 badges each 30 cm. long?

Change to meters or to decimals of a meter:

4. 7 Dm. **6.** 347 mm. **8.** 8.473 Km. **10.** 8 cm. 7.45 mm.
5. 75 cm. **7.** 6.375 Km. **9.** 63.40 Dm. **11.** 24 Km. 22.5 m.

12. A Philadelphia store is 390 ft. high. How would the height of the store be stated if it were in Madrid?

13. A house is 21 m. wide. How many ft. and in. in its width?

Metric Table of Capacity.

10 milliliters (ml.)	= 1 centiliter	(cl.)	= .01 of a liter
10 centiliters	= 1 deciliter	(dl.)	= .1 of a liter
10 deciliters	= 1 **liter**	(l.)	
10 liters	= 1 dekaliter	(Dl.)	
10 dekaliters	= 1 **hektoliter**	(Hl.)	= 100 liters

The **liter,** equivalent to about a quart, is used to measure liquids, fruits, etc. The **hektoliter** equals approximately 26.42 gal. or nearly 2.84 bu. 1 liter of water weighs 1 kilogram.

Met ic Table of Weight.

10 milligrams (mg.)	= 1 centigram	(cg.)	= .01 of a gram
10 centigrams	= 1 decigram	(dg.)	= .1 of a gram
10 decigrams	= 1 **gram**	(g.)	
10 grams	= 1 dekagram	(Dg.)	
10 dekagrams	= 1 hektogram	(Hg.)	= 100 grams
10 hektograms	= 1 **kilogram**	(Kg.)	= 1000 grams
10 kilograms	= 1 myriagram	(Mg.)	= 10,000 grams
10 myriagrams	= 1 quintal	(Q.)	= 100,000 grams
10 quintals	= 1 **metric ton**	(T.)	= 1,000,000 grams

The **gram** is the *weight* of a cubic centimeter of distilled water, and it approximates 15½ grains. A five-cent piece weighs about 5 grams. The **kilogram**, or kilo, equals about 2.2 lb. The **metric ton** is the *weight* of a cubic meter of distilled water, and it is equal to about 2204 lb.

ORAL EXERCISE

1. How many liters in 8 Hl.? 200 cl.? 2.9 Dl.? 500 ml.?

2. How many dg. in the weight of 80 nickels?

3. Reduce to grams: 250 mg.; 715 dg.; 8.3 Hg.; 2.2 Kg.; 6.2 Dg.

State the approximate equivalents in our measures:

4. 400 g. 5. 2.5 T. 6. 8.5 l. 7. 3 Hl. 8. .25 Dl.

WRITTEN EXERCISE

1. How many bottles of oil each containing 25 cl. can be filled from 300 l.?

2. What will 14.25 l. of maple sugar cost at 6¢ a dl.?

Change to our measures:

3. 78 l. 4. 12.5 Hl. 5. 220 cl. 6. 6500 ml.

7. How many kilos of sugar are there in a barrel weighing 240 lb.?

8. A merchant sold 8 metric tons of metal waste at 5¢ a Kg. How much did he receive?

Metric Table of Square Measure.

100 square millimeters (sq. mm.)	= 1 square centimeter (sq. cm.)
100 square centimeters	= 1 square decimeter (sq. dm.)
100 square decimeters	= 1 **square meter** (sq. m.)
100 square meters	= 1 square dekameter (sq. Dm.), or 1 are
100 square dekameters	= 1 square hektometer (sq. Hm.), or 1 hektare
100 square hektometers	= 1 **square kilometer** (sq. Km.)

The **square meter,** used in measuring walls and floors, is approximately 1.2 sq. yd.; the **square kilometer,** used in measuring very large areas, is nearly .4 sq. mi. The unit of land measure is the **are** (*a* as in *fare*), which is one square dekameter; the **hektare,** one square hektometer, is nearly $2\frac{1}{2}$ acres.

WRITTEN EXERCISE

1. A calendar is 24 cm. by 15 cm. Find its area.

2. A French forest district covers an area of 7400 hektares. How many acres is that?

3. Change to sq. meters: 125 sq. Hm.; 3.45 sq. Km.; 500 ares.

4. Find the area of a board 31.2 cm. long and 18.7 cm. wide.

5. A triangular kite has a base of 15.5 cm. and an altitude of 6.2 cm. Find its area.

6. How many sq. meters in a wall 27 ft. by 30 ft.?

Metric Table of Cubic Measure.

1000 cubic millimeters (cu. mm.)	= 1 cubic centimeter (cu. cm.)
1000 cubic centimeters	= 1 cubic decimeter (cu. dm.)
1000 cubic decimeters	= 1 **cubic meter** (cu. m.)

The **cubic meter** is equal to 1.308 cu. yd. (official approximation). The unit of wood measure is the **stere** (pronounced like *steer*), which is a cubic meter.

WRITTEN EXERCISE

1. A box is 15 cm. long, 12.6 cm. wide, and 6.5 cm. deep. Find its volume.

2. A cubic centimeter of water weighs 1 gram. What is the weight in dekagrams of .085 cu. m. of water?

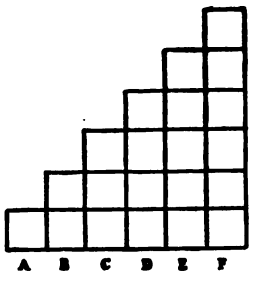
3. A monument base is 8.5 m. wide, 10 m. long, and 3.5 m. high. What is the cost at $8.50 a cu. meter?

4. How many cubic meters are there in the capacity of a car 12 m. long, 2.5 m. high, and 2 m. wide? How many cubic feet?

5. How many cubic meters of earth are there in an excavation 5 m. long, 7.5 m. wide, and 3.1 m. deep?

V. RATIO AND PROPORTION

Since 3 is $\frac{1}{2}$ of 6, we say the ratio of 3 to 6 is $\frac{1}{2}$. 3 is $\frac{1}{3}$ of 9, and the ratio of 3 to 9 is $\frac{1}{3}$. 15 is 3 times 5, so the ratio of 15 to 5 is $\frac{15}{5}$, or 3.



What is the ratio of column F to column C in the diagram? What is the ratio of A to E?

Ratio is the relation between two like numbers expressed by the division of the first by the second.

The two numbers compared are called the **terms** of the ratio. The first term is the **antecedent**; the second is the **consequent**. *The two must be, or must be made to be, of the same denomination* before the relation between them can be found. All ratios are abstract numbers.

A ratio may be expressed as a fraction, as a division, or with the sign of ratio (the colon :). The ratio of 2 to 7 may be written $\frac{2}{7}$, or $2 \div 7$, or $2 : 7$. The ratio is usually read, "2 is to 7."

We find the **value** of a ratio by dividing the first term by the second term.

ORAL EXERCISE

State the values of these ratios in connection with the foregoing diagram:

1. F to D	5. A to $D+E$	9. A to D	13. B to E
2. C to B	6. B to $C+E$	10. A to B	14. A to D
3. E to C	7. $F+E$ to D	11. B to A	15. B to B
4. E to B	8. $C+D$ to A	12. B to F	16. E to D

17. What is the ratio of 16 to 4? 20 to 5? 60 to 20? 100 to 10?

18. What is the ratio of 9 to 1? 36 to 2? 81 to 9? 800 to 8?

Reduce these ratios to lowest terms:

19. 20 : 5	**23.** 20 : 45	**27.** $133\frac{1}{3}$: 100
20. $\frac{18}{36}$	**24.** $\frac{45}{75}$	**28.** $\frac{63}{7}$
21. $12\frac{1}{2}$: 100	**25.** $83\frac{1}{3}$: 100	**29.** $87\frac{1}{2}$: 100
22. 80 : 100	**26.** $16\frac{2}{3}$: 200	**30.** 120 : 100

31. What is the ratio between 1 and $\frac{1}{4}$? $\frac{1}{2}$ and $\frac{1}{4}$?

32. What is the ratio between $\frac{1}{2}$ and 2? 2 : $\frac{1}{2}$? $2\frac{1}{2}$: $7\frac{1}{2}$?

33. What is the number whose ratio to 3 is 12?

34. A fence is 6 ft. high. The ratio of the height of a tree to this fence is $8\frac{1}{2}$. How high is the tree?

WRITTEN EXERCISE

Find the value of each of the following ratios:

1. $\frac{1}{8}$: $\frac{1}{4}$	**4.** 5 yd. : 1 ft.	**7.** 5 ft. : 25 in.
2. 3.5 : 40	**5.** 2 oz. : 1 lb.	**8.** 6 lb. : 8.5 oz.
3. $.33\frac{1}{3}$: 100	**6.** 8 hr. : 2 da.	**9.** 8 mi. : 160 rd.

10. During digestion, cabbage remains in the stomach 4 hr. 30 min.; boiled fish, 1 hr. 30 min. Express the ratio of the time required for digestion of these two foods.

11. Roast pork remains in the stomach 5 hr. 15 min.; boiled rice 1 hr. Express this ratio.

12. Raw eggs remain in the stomach 2 hr.; raw milk 3 hr. 15 min. Express this ratio.

13. In 1900, 100 lb. of peas cost \$1.30; in 1916, the price was \$8. Express the ratio between these two prices.

14. What is the ratio between 1 sq. ft. and 2 sq. yd.? Between 3 cu. ft. and 2 cu. yd.?

15. State two ratios having a value equivalent to $\frac{4}{5}$; to .75; to .1; to $\frac{3}{8}$.

Proportion. To what number has 5 a ratio equal to the ratio of 8 to 2? To what number has 9 a ratio equal to the ratio of 3 to 5?

State another ratio equal to 2 : 4; 3 : 9; 5 : 15; $\frac{4}{3}$; $\frac{9}{15}$.

Instead of writing $\frac{9}{15}=\frac{3}{5}$, we may write 9 : 15 = 3 : 5.

This expression of equality between two ratios is called a **proportion.** To express the fact that one ratio is equal to another, the double colon :: is sometimes used instead of the equality sign; as, 9 : 15 :: 3 : 5. This is read, "9 is to 15 as 3 is to 5."

The first and last terms of a proportion, as 9 and 5 above, are called the **extremes;** the second and third terms, as 15 and 3, are called the **means.**

In each of the following proportions compare the product of the means with the product of the extremes:

3 : 9 :: 5 : 15 $\qquad$ 1 : 8 = 12½ : 100 $\qquad$ 1 : 2 = 18 : 36

4 : 10 = 8 : 20 $\qquad$ 2 : 10 = 14 : 70 $\qquad$ 11 : 3 :: 22 : 6

From the foregoing, it follows that:

In a proportion, the product of the extremes is equal to the product of the means.

If one of the extremes is missing, it can be found by dividing the product of the means by the given extreme. If one of the means is missing, it can be found by dividing the product of the extremes by the given mean.

ORAL EXERCISE

Find the value of the missing term, designated by x:

1. 3 : 5 = 9 : x
2. 2 : 7 = x : 14
3. 12 : x = 4 : 8
4. x : 24 = 3 : 8
5. 2 : .2 = x : 20
6. 12 : x = 9 : 3
7. 2 : 7 = 8 : x
8. 9 : x = 18 : 2
9. x : 5 = 16 : 4
10. 5.1 : 17 = x : 10

WRITTEN EXERCISE

1. In the proportion, $x : 25 :: 32 : 20$, find the value of x:

$$20x = 25 \times 32, \text{ or } x = \frac{\overset{5}{\cancel{25}} \times \overset{8}{\cancel{32}}}{\underset{4}{\cancel{20}}} \qquad x = 40$$

Find the value of x in the following:

2. $72 : 48 = 3 : x$

3. $25 : x = 125 : 30$

4. $x : 3 = 50 : 40$

5. $12 : 16 = x : 60$

6. $40 : 60 = 70 : x$

7. $x : 8 = 44 : 88$

8. $24 : 7 = 48 : x$

9. $8.5 : 1.5 = x : 4.8$

10. $x : 32 = 10 : 9$

11. $x : 750 = 20 : 6$

12. $24 : 5 = 3.6 : x$

13. $.64 : .32 = x : .04$

14. $x : \frac{3}{4} = 6 : 24$

15. $13.5 : x = 1.8 : 4.8$

16. $15 : 16 = 225 : x$

17. $4.9 : 3.5 = x : 4.5$

18. $x : \frac{2}{3} = \frac{1}{2} : \frac{1}{4}$

19. $8.5 : .5 = 11.9 : x$

20. If $2\frac{1}{2}$ bu. of grain are used to plant 8 acres, how many bu. will be used to sow 40 acres?

21. A pole 9 ft. high casts a shadow $6\frac{1}{2}$ ft. long: how long a shadow will be cast at the same time of day by a near-by steeple 180 ft. high?

22. If \$60 yields \$2.70 interest, how much must be invested at the same rate to yield \$3.24?

23. The shadow of a chimney is 250′ long when the shadow of a loft building is 400′ long. If the loft building is 160′ high, what is the height of the chimney?

24. An engine wheel makes 80 revolutions in 12 minutes: how many revolutions will it make in $1\frac{1}{2}$ hours at the same rate?

25. On a war map a distance of 50 mi. is represented by $\frac{3}{4}$″: what distance is represented on this map by $6\frac{3}{4}$″?

26. What is the number which has to $\frac{3}{2}$ the ratio $2\frac{1}{4} : 6$?

27. If sound travels 6160 ft. in $5\frac{1}{4}$ seconds, how far will it travel in 5 minutes?

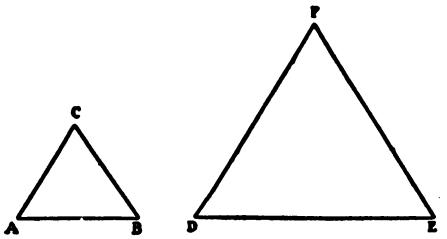
28. If 20 workmen can excavate a ditch in 12 days, in how many days can it be completed with 5 of the men laid off?

29. Find the number that has the same ratio to .25 that .7 has to .2.

30. If 12 men can build a wall in 19 days, how many men will be needed to finish the work in $\frac{1}{3}$ of the time?

31. If 24 carpenters can finish the woodwork of a ship in 36 days, how many more days will be needed to complete the work with $\frac{3}{4}$ the number of workmen?

Similar Triangles. When the corresponding sides of triangles have the same ratio, the triangles are said to be **similar**. The ratio of any two sides of one is equal to the ratio of the corresponding sides of the other.



In the diagram of two similar triangles, the side AB has the same relation to DE that BC has to EF, or $AB : DE = BC : EF$.

If AB is $\frac{1}{2}$ DE, how does AC compare with DF?

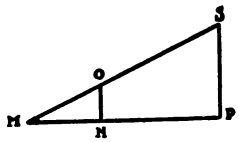
If FE is twice CB, how does DF compare with AC?

Suppose the length of EF were unknown, but that AB were 20 ft., BC, 15 ft., and DE, 40 ft. Then if x = length of EF,

$$20 : 15 = 40 : x$$

$x = 30$ ft., the length of EF.

WRITTEN EXERCISE



1. In this diagram, what proportion exists among the sides MN, MP, MO, and MS?

2. If $MN = 3$, $MP = 8$, $MO = 4$, What is the length of MS?

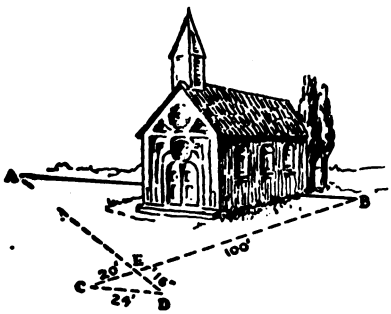
3. If $MP = 45$ ft., $MN = 25$ ft., $NO = 20$ ft., how long is PS?

4. Suppose that NO represents a fence 4 ft. high and PS a tree casting the shadow MP, 28 ft. long. If the shadow of the fence MN, is $5\frac{1}{2}$ ft., what is the height of the tree?

5. A 3-foot cane casts a shadow 7 ft. long when a flagpole casts a shadow of 160 ft. Find the height of the flagpole. Make a drawing.

6. When a lamp-post 16 ft. high cast a shadow of 35 ft., what is the height of a loft building that casts a shadow 380 ft. long?

7. The length of the shadow of a wireless aerial is 240 ft. at the same time that a bush 5 ft. high casts a shadow of $8\frac{3}{4}$ ft. What is the height of the wireless aerial?

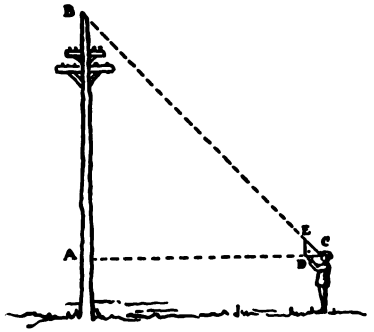


8. Suppose we are to find the distance AB, which cannot be measured directly. We select a point E, which is found to be 80′ from A and 100′ from B. We extend AE 16′ to D, and BE 20′ to C to make CD parallel to AB. CD is found to be 24′ Then $x : CD = 80 : 16$.

What other proportions will give the unknown distance?

9. The scale on a map reads: "840 statute miles to $\frac{1}{2}$ in." How many miles would be represented by $1\frac{5}{8}$ in.?

10. If $\frac{7}{8}$ in. on a map represents a distance of 322 mi., what distance will 9.2 in. represent?



11. A boy is measuring the height of a telegraph pole by means of a right triangle. He holds DC level and moves back from the pole until he can just see the top of the pole along CE. Since, in the triangle, $CD = DE$, $CD : DE = CA : AB$.

How high is the pole if C is 4′ 9″ from the ground and CA is 19′ 11″?

12. If DE had been twice CD, and CA had been 40 feet, what would have been the height of the pole?

13. In order to find the height of a soldier's monument, a boy lay on the grass where he could just sight the top of the monument in line with the top of a path railing 3 feet high. The distance from his eye to the railing was 1 ft. 4 in., and the distance from his eye to the base of the monument was 39 ft. How high was the monument?

14. In the afternoon the boy observed that the shadow cast by the monument was 251 ft. long while the shadow of the railing was 8 ft. Explain how he could check his first measurement.

15. Describe the method of finding the width of a river by means of similar triangles.

16. How could you find the distance between two trees at opposite ends of a lake?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	$40\times75¢$	$8\times\$1.87\frac{1}{2}$	$40\div\frac{2}{3}$	$463+56$	$\frac{1}{3}-\frac{1}{4}$
2.	$88\times25¢$	$12\times\$1.25$	$33\div\frac{3}{5}$	$713+93$	$\frac{1}{4}-\frac{1}{5}$
3.	$75\times50¢$	$15\times\$1.33\frac{1}{3}$	$24\div\frac{4}{7}$	$282+82$	$\frac{1}{5}-\frac{1}{7}$
4.	$80\times6\frac{1}{4}¢$	$20\times\$1.50$	$32\div\frac{8}{9}$	$515+59$	$\frac{1}{6}-\frac{1}{11}$
5.	$60\times33\frac{1}{3}¢$	$16\times\$1.12\frac{1}{2}$	$45\div\frac{5}{12}$	$922+76$	$\frac{1}{7}-\frac{1}{10}$
6.	$49\times14\frac{2}{7}¢$	$72\times\$1.83\frac{1}{3}$	$16\div\frac{4}{7}$	$372+63$	$\frac{2}{3}-\frac{1}{5}$
7.	$24\times66\frac{2}{3}¢$	$40\times\$1.62\frac{1}{2}$	$48\div\frac{6}{11}$	$565+36$	$\frac{2}{5}-\frac{2}{7}$
8.	$60\times83\frac{1}{3}¢$	$80\times\$1.75$	$54\div\frac{9}{10}$	$281+54$	$\frac{5}{6}-\frac{1}{5}$
9.	$56\times12\frac{1}{2}¢$	$56\times\$1.37\frac{1}{2}$	$63\div\frac{7}{8}$	$847+45$	$\frac{2}{7}-\frac{2}{9}$
10.	$48\times87\frac{1}{2}¢$	$48\times\$1.16\frac{2}{3}$	$72\div\frac{8}{9}$	$610+69$	$\frac{2}{3}-\frac{2}{5}$
11.	3 M. = \$?	10 rd. = ? ft.	$\frac{1}{3}+\frac{3}{4}$	$564-58$	$\frac{1}{2}+\frac{1}{9}$
12.	£7 = \$?	$4\frac{1}{2}$ lb. = ? oz.	$\frac{2}{3}+\frac{1}{10}$	$622-87$	$\frac{1}{7}+\frac{1}{8}$
13.	1 Kg. = ? lb.	$3\frac{1}{2}$ bu. = ? pk.	$\frac{3}{8}+\frac{2}{3}$	$473-48$	$\frac{1}{6}+\frac{1}{7}$
14.	1 Km. = ? mi.	12 doz. = 1 ?	$\frac{3}{4}+\frac{5}{8}$	$393-63$	$\frac{1}{2}+\frac{1}{11}$
15.	? rd. = 1 mi.	? pt. = 5 gal.	$\frac{3}{5}+\frac{2}{7}$	$711-75$	$\frac{1}{3}+\frac{1}{5}$
16.	$\frac{1}{2}$ mi. = ? ft.	? mills = \$1	$\frac{3}{7}+\frac{1}{6}$	$117-73$	$\frac{2}{3}+\frac{2}{5}$
17.	5 pk. = ? qt.	$2\frac{1}{2}$ doz. = ? units	$\frac{1}{9}+\frac{1}{3}$	$784-97$	$\frac{2}{5}+\frac{2}{7}$
18.	1 m. = ? in.	54 cu. ft. = ? cu. yd.	$\frac{5}{6}+\frac{3}{12}$	$235-43$	$\frac{2}{7}+\frac{2}{3}$
19.	30 mo. = ? yr.	2 sq. ft. = ? sq. in.	$\frac{2}{9}+\frac{7}{18}$	$561-86$	$\frac{3}{8}+\frac{2}{5}$
20.	1 liter = ? qt.	20 quires = 1?	$\frac{4}{7}+\frac{3}{5}$	$803-25$	$\frac{2}{9}+\frac{2}{3}$
21.	24 sheets = 1?	1 cu. ft. = ? cu. in.	$\frac{3}{10}+\frac{3}{8}$	$352-64$	$\frac{2}{3}+\frac{5}{6}$
22.	2 A. = ? sq. rd.	$2\frac{1}{2}$ min. = ? sec.	$\frac{5}{12}+\frac{5}{24}$	$419-38$	$\frac{1}{4}+\frac{3}{8}$
	Read:	*State results:*			
23.	CCXIX	$\$27.20+\$4.80$	$6\times4\frac{1}{2}$	$347+29$	$21\div\frac{7}{9}$
24.	MCDXX	$\$34.60+\$3.40$	$7\times3\frac{1}{7}$	$912+37$	$35\div\frac{5}{8}$
25.	MDCIX	$\$43.90+\$5.10$	$9\times4\frac{2}{3}$	$486+82$	$88\div\frac{8}{11}$
26.	XXXIV	$\$56.70+\$1.70$	$12\times3\frac{1}{4}$	$237+18$	$36\div\frac{4}{7}$
27.	MCCXL	$\$82.10+\$2.90$	$8\times11\frac{1}{8}$	$856+47$	$75\div\frac{3}{4}$
28.	XLVII	$\$37.25+\$1.30$	$10\times10\frac{1}{3}$	$347+56$	$49\div\frac{7}{8}$
29.	CLXXI	$\$24.35+\$2.60$	$16\times3\frac{1}{4}$	$565+28$	$56\div\frac{8}{9}$
30.	MCLXV	$\$39.75+\$3.20$	$14\times4\frac{1}{7}$	$918+52$	$63\div\frac{7}{10}$
31.	CXXIX	$\$43.45+\$4.40$	$12\times5\frac{1}{6}$	$239+49$	$81\div\frac{9}{11}$

GENERAL WRITTEN PROBLEMS

1. Find the compound interest on \$1200 for 2 yr. at 4%, interest compounded semiannually.

2. How many cubic feet in the volume of a cylindrical tank 10 ft. in diameter and $3\frac{1}{2}$ ft. deep?

3. What are the proceeds of a note for \$175 discounted at 5% for 144 days?

4. An artificial fishpond is made with a circular concrete bottom 20 feet in diameter. How many sq. yd. of concrete in the bottom?

5. How many city lots $20' \times 100'$ can be made from a square section of land 80 yd. long?

6. How many sq. ft. of sheet iron on the outside of a smokestack $2\frac{1}{2}$ ft. in exterior diameter and 35 ft. in height?

7. At $6\frac{1}{2}¢$ a sq. ft., find the cost of constructing a fence 6 ft. high around a square lot 100 ft. long.

8. Find the cost of 15 dozen chairs listed at \$9 a dozen, with discounts of 20%, 20%, and 10%.

9. A cabinet is to be constructed so as to contain 105 cu. ft. If it is 6 ft. high and 3 ft. 6 in. deep, how wide must it be made?

10. A circular flower bed is 28 ft. in diameter. At 10¢ a sq. ft., what will be the cost of laying a cement path 3 ft. wide around the outside of the flower bed?

11. Find the amount of \$750 for 21 da. at 6% interest.

12. How many sq. ft. are there in the curved surface of a cylindrical pillar $3\frac{1}{3}$ ft. in diameter and 28 ft. in height?

13. A contractor estimates that 3 men can do a piece of work in $8\frac{1}{2}$ days. If he puts 5 men on this work, how many days should they take to finish it?

14. How many bushels can be stored in a bin 4 ft. square and 7 ft. deep?

15. At 55¢ a cubic yard, how much will it cost to excavate a cellar 42 feet long, 26 feet wide, and $7\frac{1}{2}$ feet deep?

16. A tool box is 24 in. long, 14 in. wide, and $10\frac{1}{2}$ in. deep. How many cu. in. does the box contain?

17. If 18 men lay a wall in 17 days, how many men will be required to do the work in 51 days?

18. The diameter of a wagon wheel is 4′ 6″. How much ground will it cover in making 10 complete revolutions?

19. Find the cost of filling with oats a bin 8′ long, 7′ wide, and 6′ deep, if the price of oats is 70¢ per bu.

20. A cylindrical stone monument is 20 ft. high and 1 ft. 2 in. in diameter. How many cu. ft. does it contain?

21. A circular grassplot has a 20-foot radius. How much farther is it to walk around the edge of the plot to a point directly opposite the starting point, than to take the shortest cut?

22. At 8¢ a lb. find the duty on 100 casks of dyes each containing 25 kilograms.

23. A piece of machinery was listed at $1250 and sold for $900. Find the per cent of discount.

24. A candy box in triangular form is $3\frac{1}{3}$ in. high. If the area of the base is $42\frac{1}{2}$ sq. in., what is the volume of the box?

25. If 9 men accomplish a certain task in 20 days, in how many days can 12 men do the work?

26. Find the area, in hektares, of a field 24 Hm. long and 80 Dm. wide.

27. What is the compound interest on $420 for 2 years at 4%, if the interest is compounded semiannually?

28. A boy weighs 68.3 Kg. How many lb. does he weigh?

29. How long will 196 lb. of flour last a family that consumes 49 lb. in 30 weeks?

VI. INDUSTRIAL PROBLEMS

PROBLEMS OF THE SHOP

1. How wide a board will remain after sawing a $3\frac{11}{16}$ in. strip from an $8\frac{3}{8}$ in. board?

2. Select boards to combine with each of the following to give a width of 18 in.: $3\frac{3}{8}$ in.; $7\frac{3}{16}$ in.; $4\frac{3}{4}$ in.; $7\frac{9}{16}$ in.

3. How many board feet in a piece of lumber 1 in. thick, 6 in. wide, and 10 ft. long?

Lumber is measured by board feet, a unit of measure 1 foot square and 1 inch thick.

4. A piece of lumber 16 ft. long, 4 in. wide, and 2 in. thick contains how many board feet?

5. The base of a bookstand is to be $20'' \times 5\frac{1}{2}''$ and each of the two ends a $5\frac{1}{2}''$ square. For waste in cutting, allow for each piece $1''$ lengthwise and $\frac{1}{2}''$ widthwise. Tell how many board feet will be required for 10 stands.

6. How many board feet of lumber will be required to make a covered box $2\frac{1}{2}$ ft. long, 15 in. wide, and 20 in. deep outside measure, using inch boards?

7. A picture frame whose outside dimensions are $24\frac{1}{2}$ in. $\times 15$ in. is made from molding $2\frac{1}{2}$ in. wide. How many feet and inches of molding remain after cutting what is required from a 10-foot strip?

8. At 8¢ a sq. ft., estimate the cost of the lumber that must be worked up in making two shelves and a top piece for a kitchen closet, the top and shelves being in the form of a right triangle $18'' \times 18''$.

9. Find the cost of 1250 board ft. at \$36 per M.

PROBLEMS OF THE FARM

1. A farmer had four loads of hay weighing respectively 1875 lb., 2013 lb., 2092 lb., 1283 lb. He sold the hay at $13 per ton. How much did he receive for it?

2. What is the cost per acre for plowing, if one man with three horses plows 2 acres in 9 hours at 30¢ an hour for the man's time and 15¢ an hour for each horse?

3. A farmer raised 12 acres of asparagus. He paid per acre $42 for fertilizer, $16 for labor, and $42 for cutting and shipping. Each acre yielded 1850 bunches which sold at 12¢ a bunch. Allowing a selling commission of 3%, what was the total profit on the 12 acres?

4. A farmer desired to grind together oats and barley at the ratio of 3 bu. of oats to 2 bu. of barley. He had 54 bu. of barley. What was the quantity of oats required?

5. How much will a farmer receive for sugar beets at $6.60 a ton if he raises 27.5 acres of beets that average 9.81 tons to the acre?

6. A farm in the form of a rectangle $\frac{1}{2}$ mi. long and $\frac{1}{4}$ mi. wide was sold at $125 per acre. How much did it bring?

7. The rows in a potato field are 3 ft. 8 in. apart. If the field is $\frac{1}{4}$ mi. long, how many rows make an acre?

8. How many cu. ft. of ensilage can be stored in a farm silo 20′ in diameter and 36′ in height?

9. If the ensilage averages in weight 45 lb. to the cu. ft., what is the total weight of the ensilage in this silo?

10. At $32 per ton, find the cost of fertilizer for 900 young trees, allowing 1.25 lb. to a tree.

11. A cellar 28′×32′×6′6″ has been excavated for a farmhouse. Find the cost at 40¢ per cu. yd.

12. How many lb. of cream in 253 lb. milk in which the ratio of the cream to the rest of the milk is as 2 to 9?

PROBLEMS OF THE MACHINIST

1. Find the total pressure on a piston head 36 in. in diameter, if the pressure on each sq. in. is 110 lb.

2. What is the total external surface of a boiler tube 4″ in diameter and 20′ long?

3. The diameter of the dial of a large clock in a tower is to be 28 feet. (*a*) How many sq. ft. of glass will be needed to construct the dial for this clock? (*b*) If the minute hand reaches to within 6 inches of the edge of the dial, how many feet does the end of the minute hand travel in one hour?

4. Find the weight of a steel piston 10 ft. long and 4 in. in diameter if 1 cu. ft. weighs 490 lb.

5. How far is it around a wheel which measures $3\frac{1}{2}$ ft. from the center of the hub to the outside of the rim?

6. The funnel of a steamer is 22 in. in diameter. Find the area of a circular cover for it, allowing one inch for overlap all around.

7. The diameter of the head of a steel oil barrel is 2.5 feet. How many sq. ft. of metal in 16 barrel heads?

8. How many square feet of tin are needed to make a stovepipe $4\frac{1}{2}$ feet long and 5 inches in diameter, allowing one inch for overlapping?

9. From a rectangular sheet of copper $8'' \times 10\frac{1}{2}''$, I desire to cut the largest possible circle. How many square inches of the metal will be wasted in the cutting?

10. The pressure of steam in an engine boiler is 140 pounds to the square inch. What is the pressure on a valve 2 inches in diameter?

11. What is the lowest door through which a man can roll a wheel 18 ft. in circumference?

12. Find the area of the top surface of an emery disc which measures .875 in. in diameter.

TRANSPORTATION PROBLEMS

1. A freight car is 38′ long, 8′ 3″ wide, and 8′ 6″ high, inside. How many cu. ft. of goods will it hold?

2. A knot, or nautical mile, is about 1.15 miles. The distance from New York to Havre is 3157 knots. This is approximately how many miles?

3. In one year 256,296,936 tons of bituminous coal were carried by railroads in the United States. Tell the average number of tons moved per month.

4. The inside dimensions of a car are 36′×8′×4′. Find the cost of its carload of oats at 31¢ per bu.

5. The freight rate from New York to San Francisco by rail is \$2 per 100 lb.; by the Canal route it is \$1.12½ per 100 lb. What per cent of the cost by rail will be saved by shipping through the canal?

6. Find the freight charges on:

Oranges in boxes weighing 1265 lb. @ \$.22½ per cwt.
Iron fittings weighing 5640 lb. @ .14 per cwt.

7. An express train leaves Buffalo at 1 P.M. and arrives in Albany at 6.57 P.M. The distance is 296.53 mi. Compute the average number of mi. per hour made by the train.

8. The total weight of a locomotive is 853,000 lb. If 89% of the total weight is on the driving wheels, how much of the weight do these bear?

9. To ship grain by railroad costs 11¢ per bu.; by whaleback steamer it costs 1¼¢ per bu. How much would be saved by shipping by water a cargo of 240,000 bu.?

10. The weight of a steel freight car is 36,000 lb. If its capacity is 100,000 lb., what per cent of its weight is its capacity?

11. A locomotive weighing 203 tons can exert a pull of 16% of its weight. How many pounds of pull can it exert?

PROBLEMS OF THE FACTORY

1. How long should a spoke be made for a wheel whose circumference is $18\frac{1}{4}$ feet (no allowance being made for hub or rim)?

2. How many in. of metal border will be needed to run a strip around a circular piece of iron 21″ in diameter?

3. Find the weight of a cast iron shaft 18′ long and 4″ in diameter, if 1 cu. ft. of cast iron weighs 450 lb.

4. Find the area of the largest circular piece of tin that can be cut from a sheet $3\frac{1}{2}$ ft. square.

5. How many sq. in. of sheet iron will be needed to make tops for eight triangular-shaped supports, the base of each top being 18 in. and the altitude 14 in.?

6. If a certain standard steel girder weighs $44\frac{1}{2}$ lb. to the foot, what is the weight of a girder 32′ 6″ long?

7. Compute the total pressure on a cylinder head whose diameter is 14 in., when the pressure per sq. in. is 160 lb.

8. Of a bronze casting, 70% is copper, 25% zinc, and 5% tin. How much of each metal is there in 60 lb. of the bronze?

9. A workman is making a casting of 170 lb. of metal. If $3\frac{1}{2}$% of the weight is lost in melting, how much metal must be melted to furnish this weight?

10. The wooden pattern from which a casting is to be made weighs $8\frac{1}{2}$% of the weight of the metal. If the pattern weighs 41.5 lb., how much does the casting weigh?

11. If the brass will shrink 1.75% of the length in cooling, how long must the mold be made for a brass bar that is to measure 20″?

12. A pattern for a casting is 4′ long, 3′ wide, and 8″ thick. If the shrinkage is $\frac{1}{8}$ in. to the foot, what are the dimensions of the casting from this pattern?

PROBLEMS OF THE STORE

1. A merchant has \$2500 invested in his grocery stock. Last year his net profits were \$255. Tell his gain per cent.

2. He bought 300 bananas for \$3.50 and sold them at the rate of 20 cents a dozen. If 9 bananas spoiled, what was his gain per cent?

3. He buys 44 bushels of potatoes at \$1.75 per bushel. He sells 25 bushels at a profit of 20%. The remainder show signs of decay, so he wishes to dispose of them at once. For how much a bushel must be sell the remainder to avoid loss on the whole transaction?

4. This dealer had the good fortune to get 400 heads of lettuce for \$8. He sold all but 48 heads for 5¢ each. Of those 48 he sold 10⅔% for 1¢ each, and the rest decayed, so he had to throw them away. How much did he gain?

5. If he buys 63 gal. of molasses for \$25.20, at what price per qt. must he sell it to gain 20% per qt.?

6. He has some canned goods that cost him \$45. At what price must they have been marked if, when fresh vegetables come in, he can take off 10% and still gain 10%?

7. He insured his stock of goods, valued at \$2500, for ⅞ of its value, at \$1.65. What was the premium?

8. He used during the summer 2½ tons of coal bought at \$6.75 per ton. It is estimated that 15,000 cu. ft. of gas gives as much heat as one ton of coal. Gas would have cost him 80¢ per thousand cubic feet. Would he have saved or lost by using gas, and how much?

9. He bought for \$18,500 the building which contained his store. He paid 45% of this sum in cash and gave a mortgage for the rest. How much did he pay in cash?

10. The interest rate on the mortgage was 5½%. How much interest does he pay every year?

PROBLEMS OF THE COOKING CLASS

1. A cake requires 2 eggs at 40¢ a doz.; 1 cup ($\frac{1}{2}$ lb.) of sugar @ 9¢ a lb.; $\frac{1}{4}$ lb. butter at 48¢ a lb.; $\frac{1}{2}$ cup milk (1 cup = $\frac{1}{2}$ pt.) at 10¢ a qt.; flour, 5¢; baking powder, 2¢; flavoring, $1\frac{1}{2}$¢. Find the total cost.

2. A girl is making candy for Field Day. She uses 4 cups (1 cup = $\frac{1}{2}$ pt.) of maple syrup @ 45¢ a qt. and 2 cups of cream @ 28¢ a pt. and 2 lb. of nuts for 25¢. Find the profit if she sells 2 lb. of the candy @ 75¢ a lb.

3. A certain receipt for preserving fruit calls for 7 oz. of sugar to $2\frac{1}{2}$ lb. of fruit. If the sugar costs 10¢ a lb. and the fruit $9\frac{1}{2}$¢ a lb., find the cost of preserving 20 lb. of the fruit.

4. A cooking class put up 48 pint jars of raspberry jam. They used 1 pint of raspberries and $\frac{1}{2}$ lb. of sugar per jar. If the sugar cost 10¢ a lb. and the berries 12¢ a qt., find the total cost.

5. Estimate the cost of making apple dumplings, for six persons, as follows: 1 pt. milk at 9¢ a qt.; 6 apples at 3¢ each; 2 cups flour (8 oz.) at 6¢ a lb.; butter, 8¢; baking powder, 3¢; sugar, $3\frac{1}{3}$¢; salt, $\frac{1}{6}$¢; sauce, 12¢. Tell, also, the average cost per person.

6. We pay 35¢ for a 7-lb. bag of buckwheat flour. How much per lb. can we save by buying it in $24\frac{1}{2}$-lb. bags at 98¢?

7. The class prepared for six people a breakfast consisting of strawberries, \$.40; sugar, \$.02; cereal, \$.04; rolls, \$.12; eggs, \$.30; butter, \$.15; coffee, \$.09; cream, \$.16. Compute the average cost per person.

8. If a girl allows $1\frac{5}{8}$ pt. of milk to each person, how many portions can she serve from 2 gal. 3 qt. $\frac{3}{4}$ pt. of milk?

VII. BUSINESS FORMS: HOUSEHOLD ACCOUNTS

A Household Account. The custom is growing with intelligent housekeepers, particularly in these days of increasing prices, to keep account of the home expenses. To have done so enables one to know how much it is costing to run the home, also to discover how much and where to retrench if one is to keep within last year's outlay, or within present income, and perhaps save a little.

We are familiar with the following form:

1918		*Receipts*			*1918*		*Expenses*		
Apr.	*1*	*Cash on hand*	*28*	*75*	*Apr.*	*3*	*Groceries*	*5*	*90*
	6	*Received*	*35*			*3*	*Clothing*	*8*	*50*
						4	*Meat*	*4*	*35*
						4	*Rent*	*35*	*00*
						6	*Vegetables*	*2*	*80*
						8	*Papers*		*38*
							Balance	*6*	*82*
			63	*75*				*63*	*75*
Apr.	*8*	*Cash on hand*	*6*	*82*					

WRITTEN EXERCISE

1. A family's expenses for a month as shown by their account were: food, \$49.50; rent, \$36; light, \$4.18; clothing, \$31.70; furnishings, \$12.25; doctor, \$8; sundries, \$18.25. If the monthly income was \$210, how much was saved?

2. Balance the following family account. Supply dates of a 2–wk. period. On hand, \$48.33. Receipts: \$15, \$15, \$5. Expenses: \$25, \$1.88, \$12.10, \$1.46, \$3.22, \$14.08.

Supplying dates, make out and balance the following:

3. Receipts for a month: cash on hand, $24.96; from Mr. A., $65; from Harry, $12; from Joe, $20. Expenses: rent, $28; light, $2.75; ice, $1.40; laundry, $5.75; groceries, $18.44; butcher, $10.68; clothing, $14.35; incidentals, $14.35.

4. Receipts: on hand, $8.87; salary, $20. Expenses: board, $7; laundry, $.62; carfare, $.75; recreation, $3.50.

Weekly Expense Account.

For the week ending.....

	Mon.	*Tue.*	*Wed.*	*Thurs.*	*Fri.*	*Sat.*	*Sun.*	*Totals*
Carfare	.20	.40	.85	.15	.55	.20	.40	
Charity	.05			.10			.50	
Clothing			3.20		.85	.98		
Food	3.45	4.10	3.78	3.15	3.68	2.70	4.82	
Help	1.75	1.75	1.75	1.75	1.75	1.75		
Health			3.00	.45	.15			
Incidentals	.70	1.15	.75	.68	.25	1.05	.45	
Insurance						1.58		
Laundry		.20				2.65		
Papers	.04	.04	.02	.02	.03	.04	.15	
Recreation	.20	.15	1.15	.45	1.25	2.50	.50	
Totals								
Receipts						$125.00		

Total Receipts $.....
Total Expenses .....
Total Savings .....

This is another form of family account. From this one it is convenient to find the daily and weekly expenses and also the total of any one class of expenditures.

WRITTEN EXERCISE

1. In the preceding account, cast up the total for each class of expense for the week. What is the average daily expense? What are the total savings for the week?

2. Mr. James Brewster keeps a household account for one month. He finds that groceries cost \$15.13; meat, \$11.53; rent, \$34; clothing, \$16.75; fuel, \$12.45; gas, \$2.85; milk, \$5.10; laundry, \$3.20; help, \$22.50; insurance, \$3.10; amusements, \$3.85; carfare, \$3.15; additional expenses, \$14.48. If his total income is \$230, draw up his balance on hand.

3. Mr. Brewster found that the monthly bills for lighting his house for a year were as follows: \$3.15, \$2.85, \$3.47, \$3.26, \$3.04, \$3.17, \$2.55, \$2.10, \$1.88, \$2.08, \$3.86, \$3.95. Find the cost per average month.

4. By urging economy on his household, Mr. Brewster caused his lighting bills for the following year to be \$2.74, \$2.20, \$2.50, \$2.92, \$2.86, \$3.01, \$2.10, \$1.72, \$1.43, \$1.65, \$2.01, \$2.45. Find the average cost per month for this year. What was the saving in average monthly cost?

5. On June 1, Mr. Williams had on hand \$150.85. His receipts for the month were: June 2, salary \$125; June 15, semiannual interest on \$350 worth of shares in a loan association at 5% per annum. His expenditures were: June 1, street car tickets, 70¢; board and room, \$10; June 7, laundry, 25¢; June 8, street car tickets, 70¢; board and room, \$10; June 10, theater tickets, \$2; June 14, laundry, 54¢; June 15, board and room, \$10; two shirts \$3; street car tickets, 50¢; June 17, trip to amusement park, \$1.25; June 22, board and room, \$10; street car tickets, 70¢; June 27, suit of clothes, \$24.50; June 29, board and room, \$10. Make up the above account and balance it.

6. On Feb. 1 a man had $106.22 on hand. His income for the month was his salary, $175. His expenses were: Feb. 4, 3 T. coal @ $9.25 a ton; Feb. 6, rent, $38; Feb. 8, meat bill, $14.96; Feb. 11, clothing, $21.60; Feb. 18, milk bill, $5.15; Feb. 28, paid maid $18 for services; gas bill, $3.26; laundry, $2.85; carfare, $2.25; amusements, $7.75; insurance on furniture, value $1850, at $\frac{1}{4}\%$; incidental expenses, $18.45. Write out his February account and balance it.

7. A soldier in a training camp for one month kept a personal account as follows: On hand, May 1, cash, $110. Expenses: May 1, khaki suit, $28.50; shoes, $5.85; hat, $1.90; suit case, $6.50; canvas leggings, $1.85; sleeping car tickets to camp, $1.55; May 3, newspapers, 10¢; May 5, books, $2.25; tent lamp, $4; crackers, 20¢; May 9, postage, 18¢; amusement, 50¢; May 11, dinner, $1.25; church, 75¢; May 13, newspapers, 10¢; clothing, $5.50; May 15, amusement, 55¢; carfare, 85¢; crackers, 25¢; May 18, church, 75¢; books, $1.20; May 21, newspapers, 15¢; crackers, 20¢; May 23, books, $1.85; dinner, $1.25; excursion ticket, 45¢; May 25, carfare, 30¢; May 26, amusement, 55¢; dinner, $1.25; May 28, newspapers, 15¢; clothing, $3.85; laundry, $2.20; May 29, dinner, $1.25; May 30, postage, 12¢; newspapers, 10¢; May 31, carfare, 45¢; dinner, $1.25; car tickets, $2.20. Receipts: salary, $100. Make out his account and find the balance.

8. A housekeeper started the week of July 6 with $18.17 on hand. She received $32 for running expenses. Her expenditures were: July 6, 2 lb. tea @ 45¢; 1½ doz. eggs @ 60¢; 1 bag flour for 45¢; July 8, 4 pkgs. wheatena @ 14¢; 2 lb. dinner biscuit @ 36¢; July 11, 3 lb. butter @ 44¢. Make up the household account for the week and balance it for July 13.

PROBLEMS IN EARNINGS, SAVINGS, AND DISBURSEMENTS

1. After graduating from high school, John kept books in a store where he earned $40 a month. Living at home he did not pay board. His clothing and other expenses amounted to $150 a year. How much did he save in two years?

2. John started to a college where his tuition was $75; board, $2 a week; room, $1 a week; books, $20 for the year. If he allowed himself $75 for general expenses, what was the cost for a year of 36 weeks at college?

3. John finds that by working for his board and room he can save their cost. What will the year now cost? What per cent of the former yearly total will thus be saved?

4. To eke out the money he has saved, how much will John have to borrow to pay for four years at college if he works for his board and room? What will be the interest on this amount for two years at 6%?

5. During his first vacation John sells books. The books are delivered to him at $2.50 each. He sells them at $4 each. What is his per cent of gross profit on each book?

6. During the 60 days that he worked John sold 221 books. His total average expense was $2.25 a day. What was his total profit for the summer?

7. During the second year at college John took a laundry agency instead of working for his board. He was allowed a commission of 25% on all the money that he collected. During the year he collected $221.60. Did he make more or less than the price of his board, and how much?

8. During the first five years after leaving college, John earned $6450. If he had remained in the store and had received an increase of 10% each year on the salary of the previous year, how much would he have earned in these five years?

9. A girl buys on credit a winter suit and hat, paying \$1.25 a week for 11 weeks for the suit, and 50¢ a week for 8 weeks for the hat. She could have bought a suit and hat of the same grade for \$10 cash and \$2.75 cash, respectively. What per cent did she lose by the instalment plan of buying?

10. In the winter, is it thriftier for the girl to buy two woolen waists at \$2.25 each, or four cotton ones at 79¢ each, two of the latter requiring to be laundered each week at 15¢ a week? How much and what per cent will she save during six months (of 4 weeks each) by following the plan you think best?

11. On February 10, 1911, a man bought a piano. The purchase price was \$415. He paid \$35 down and agreed to pay \$12 a month until the entire amount should be paid. If the company charges $\frac{1}{2}\%$ per month interest upon unpaid balances, find the amount of the payment March 10, 1911; April 10, 1911.

12. How much is still owing on the piano June 10, 1912?

13. The piano is insured for $\frac{4}{5}$ of its value, and the premium was 60¢ on each \$100. The payment of two premiums at one time covered the insurance for three years. What was the amount of the first premium, and what per cent is it of the cost of the piano?

14. A sales girl receives a discount of 6% on all goods that she buys in the store where she is employed. How much will she save on the following items: 1 pr. pumps, \$5.50; 3 pr. hose, \$1; 1 pr. gloves, \$1.50; 1 lawn waist, \$3; 1 belt, 50¢; and $6\frac{1}{2}$ yd. lace at $12\frac{1}{2}$¢ a yd.? A month later the prices of shoes, gloves, and belt were increased 10% while the other items were marked down 25%. Would she have gained or lost had she waited, and how much?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	State approximate equivalents:				
1.	£9	300 M.	70 fr.	£7	£15
2.	36 M.	500 R.	25 M.	80 M	8s.
3.	£15	£25	80 R.	11s.	£220
4.	100 R.	15s.	500 fr.	£21	300 fr.
5.	6s.	1000 M.	1000 R.	140 R.	2000 fr.
	Read:		*Tell the answers:*		
6.	XCIX	DCXL	48.3+7.1	$\frac{1}{2}\%$ of 600	2.84−.92
7.	DLXXV	CXVII	36.8+5.2	$\frac{1}{4}\%$ of 200	8.13−6.1
8.	DXIX	MDC	24.9+6.1	$\frac{1}{3}\%$ of 1200	9.27−3.07
9.	CCV	DXCV	23.4+5.7	$\frac{1}{5}\%$ of 2000	4.08−2.06
10.	MDXC	MMDC	27.9+8.1	$\frac{1}{8}\%$ of 1600	3.91−1.01
	Change to common fractions:			*Find values:*	
11.	8%	60%	$8\frac{1}{3}\%$	$12\frac{1}{2}\%$ of 480	34.8 +14.2
12.	7%	35%	$62\frac{1}{2}\%$	$83\frac{1}{3}\%$ of 360	6.72+3.05
13.	15%	45%	85%	$14\frac{2}{7}\%$ of 210	22.07+32.3
14.	$6\frac{1}{4}\%$	80%	$16\frac{2}{3}\%$	$37\frac{1}{2}\%$ of 640	54.16+4.04
15.	$2\frac{1}{2}\%$	$12\frac{1}{2}\%$	$83\frac{1}{3}\%$	$66\frac{2}{3}\%$ of 390	98.01+2.02
	State results:				
16.	27×2	5×24	3.96+2.3	90% of 310	84÷6
17.	23×6	7×23	29.09+4.8	$112\frac{1}{2}\%$ of 80	49÷2
18.	16×9	4×45	82.01+6.08	$133\frac{1}{3}\%$ of 60	68÷4
19.	13×9	2×38	4.24+1.09	$83\frac{1}{3}\%$ of 1200	110÷5
20.	45×5	8×220	49.63+1.07	$87\frac{1}{2}\%$ of 1600	159÷3
21.	13)65	$\frac{5}{8}$ of 320	80 @ 25¢	48 @ $16\frac{2}{3}$¢	$15\times\frac{2}{5}$
22.	27)54	$\frac{2}{3}$ of 480	35 @ 50¢	36 @ $66\frac{2}{3}$¢	$18\times\frac{5}{6}$
23.	6)96	$\frac{3}{4}$ of 600	96 @ $6\frac{1}{4}$¢	30 @ $83\frac{1}{3}$¢	$33\times\frac{2}{3}$
24.	12)84	$\frac{3}{11}$ of 88	27 @ 25¢	66 @ $33\frac{1}{3}$¢	$48\times\frac{5}{8}$
25.	14)56	$\frac{5}{12}$ of 144	16 @ $87\frac{1}{2}$¢	60 @ $16\frac{2}{3}$¢	$72\times\frac{2}{9}$
26.	17)102	$\frac{2}{9}$ of 117	48 @ $62\frac{1}{2}$¢	96 @ $12\frac{1}{2}$¢	$64\times\frac{3}{8}$

GENERAL WRITTEN PROBLEMS

1. A dealer bought 4800 yd. of muslin at $8\frac{3}{4}¢$ a yd. and received a discount of 4% by paying within 10 da. Obtain and state the net cost of the goods.

2. A piece of copper in circular form has a radius of $10\frac{1}{2}$ in. Find the circumference and area.

3. A map is drawn on the scale of $\frac{1}{2}$ in. to 125 mi. At this rate what is the actual distance between two cities placed $8\frac{2}{3}$ in. apart on the map?

4. The ratio of cream to the rest of the milk in a certain grade is 1 to 3. At this rate how many gallons of this grade of milk will produce 6 qt. of cream?

5. A factory worth $36,000 was insured for $\frac{2}{3}$ of its value at $\frac{5}{8}\%$. How much was the owner's loss by a fire which destroyed the factory? How much did the insurance company lose?

6. What will the shipper receive from a sale of 576 bbl. of flour at $5.50 a bbl., if the commission charge is $3\frac{1}{2}\%$ and the freight charge is $.33 per bbl.?

7. If a canal toll per net ton on freight-carrying vessels is $1.20, what must be paid in tolls on a freighter of 6425 tons?

8. A book that is listed at $1.50 was bought at a discount of $33\frac{1}{3}\%$. If it is sold at the list price, what is the gain per cent?

9. A man built a house costing $6500 on a lot worth $1500. If he pays annually $38 for insurance, $80 for taxes, and $82 for repairs, what rent per month must he charge in order to make a profit of 6% on his investment?

10. A dealer bought 640 gal. of oil for $115.20. At what price per gal. must he sell it to make a profit of 25%?

11. Find the discount and the proceeds of a note for $2975 drawn for 63 days at 5%.

12. What is the interest on \$2240 for 2 years, 3 months, and 15 days at 4%?

13. If 24 lb. of bacon cost \$7.68, how much must be paid for 5 lb.?

14. A storekeeper purchased hats at \$54 a doz., less discounts of 20% and $16\frac{2}{3}\%$. What per cent of profit does he obtain by selling these hats at \$5 each?

15. If a street is 60′ wide and $\frac{1}{8}$ mi. in length, what will it cost to pave it at \$1.20 a sq. yd.?

16. A note for \$1200 payable in 4 mo. with interest at 5% was discounted at date of making at 6%. What were the proceeds?

17. The monthly expense account of a man and his wife is as follows: interest on mortgage, \$30; carfare, \$5.85; food, \$18; wages, \$4.95; gas, \$1.95; electricity, \$1.50; laundry, \$1.20; clothes, \$18.75; telephone, \$1.95; insurance, \$7.65; church, \$.90; books, \$5.40; amusements, \$4.20; incidentals, \$4.20; savings, \$43.50. At this monthly rate find their yearly expenditure for food, clothes, insurance. What was the man's annual salary. What per cent of his income was spent for interest on mortgage? For amusements? What per cent was saved?

18. A cylinder of $\frac{3}{4}''$ metal is fitted around a steel rod $2\frac{1}{2}''$ in diameter. Compute the inner circumference of a metal band which is to encircle the cylinder.

19. If $4\frac{3}{8}$ yd. of cloth cost $\$13.12\frac{1}{2}$, how many yd. can be bought for \$48.60?

20. An oil tank is 30 ft. deep and 143 ft. in circumference. Find its capacity in cubic feet.

21. The tank on a sprinkling cart is 7 ft. long and $3\frac{1}{2}$ ft. in diameter. Find its capacity in gallons.

22. Calculate the number of cubic feet in a mahogany log 20 ft. long and 18 in. in diameter.

VIII. SIMPLE EQUATIONS: OPTIONAL WORK

Simple Equations. It is often of advantage in the solution of problems to represent numbers by the use of letters.

PROBLEM: A rectangular field is three times as long as it is wide, and the distance around it is 320 feet. Find its length and its width.

In solving this problem we may let x represent the width. Then $3x$ = the length, and $2x+6x=320$ feet, the perimeter.

An expression of equality between two quantities, like $2x+6x=320$ feet, is called an **equation.** $2x+6x$ is the **first member** of the equation, and 320 feet is the **second member.** When we find the value of the unknown number, x, we **solve** the equation.

Since the two members of an equation are equal, if follows that:

(1) *The same number may be added to, or subtracted from, both members of an equation without destroying the equality.*

(2) *Both members of an equation may be multiplied or divided by the same number without destroying the equality.*

SOLUTION OF FOREGOING PROBLEM: We found above that:

$$2x+6x=320 \text{ feet}$$

or $$8x=320 \text{ feet, the perimeter}$$

Dividing each number by 8, we have:

$$x=40 \text{ feet, the width}$$

Then $$3x=120 \text{ feet, the length}$$

ORAL EXERCISE

Find the value of x in each of the following equations:

1. $22=70-x$
2. $7+x=8+16$
3. $\frac{1}{4}x=12$
4. $9\times 2=6x$
5. $800=4x$
6. $15x=\frac{2}{3}$ of 120

WRITTEN EXERCISE

1. From a sum of money in the bank, a man drew out 15%. His balance then was \$255. How much had he on deposit at first?

Let x = the sum on deposit
Then $x - 15\%$ of $x = \$255$
or $.85x = \$255$
Dividing each member by .85, we have
$x = \$300$

2. There are 12 more boys' classes than girls' classes in a school, and the total number of classes is 84. How many classes of each sex are there?

Let x = the number of girl's classes
and $x+12$ = the number of boy's classes
Then $x+x+12 = 84$
$2x = 72$
$x = 36$, the number of girls' classes
$x+12 = 48$, the number of boys' classes

3. A certain number of feet of wire cable added to the $173\frac{1}{2}$ feet already on hand, will make up a full spool of $342\frac{3}{4}$ feet. Find the number of additional feet needed to fill the spool.

4. A dealer sold an automobile for \$544, which was 15% less than it cost. Tell the cost.

5. A boy paid \$6.25 for a sweater, a pair of gym. shoes, and a tennis racket. The sweater and the shoes were the same price but the racket cost three times as much as the sweater. Find the cost of each article.

6. A regiment lost 45% of its men and had 704 left. How many men had it at first?

7. A girl's cousin is $1\frac{2}{3}$ times as old as the girl is, and the sum of their ages is 28 years. How old is the cousin?

8. The distance around a park is 1800 feet, and the width is $\frac{7}{8}$ of the length. Find the length and the width.

9. A clerk's salary has been increased 20% so that it is now \$1620. What was the former salary?

10. If the rate of gain is 15%, what is the cost of goods which are sold at a profit of \$76.80?

11. If a man spends 12% of his income for clothes, and this sum is \$268.80, how much is his income?

12. A buyer ordered 15 lamps at \$9.50 each. If the net cost was \$85.50, what was the rate of discount allowed?

13. A herder sold cattle at an advance of \$84 on the cost, gaining 20% thereby. With the proceeds he bought sheep at \$4.20 each. How many sheep did he buy?

14. A horse cost \$160, and $\frac{3}{4}$ of its cost is three times the cost of a cow. How much did the cow cost?

15. What sum loaned for 2 years 6 months at 4% will yield an interest of \$160?

16. A real estate dealer was forced to sell a lot for \$960 at a loss of 30%. How much did the lot cost him?

17. An agent sold a shipment of grapefruit for \$840.20, receiving a commission of \$42.01. What was the rate of commission?

18. An investor sold 300 shares of mining stock for \$2886, thereby losing 14%. How much did the shares cost him?

19. A farm of 60 acres was sold at a loss of \$1260, or 14% of the cost. Find the selling price per acre.

20. The part of a bridge pier under water is $\frac{2}{3}$ as high as the part out of water. The whole height is 45 feet. Find the height of each part.

21. At what rate per cent will \$3500 amount to \$3955 in 3 years, 3 months?

22. A dealer sold a set of automobile tires for \$120, thereby gaining $4\frac{1}{2}$%. What did the tires cost him?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	State the interest at 6% on:			*Find values:*	
1.	\$800, 6 mo.	\$400, $\frac{7}{8}$ yr.	\$1100, $\frac{2}{3}$ yr.	$6\times\frac{4}{15}$	$\frac{4}{5}\div\frac{2}{5}$
2.	\$500, 8 mo.	\$340, 60 da.	\$1200, $\frac{3}{4}$ yr.	$9\times\frac{7}{8}$	$\frac{8}{9}\div\frac{5}{9}$
3.	\$640, 1 yr.	\$600, 90 da.	\$2400, 6 da.	$8\times\frac{2}{3}$	$\frac{8}{15}\div\frac{2}{15}$
4.	\$900, 4 mo.	\$400, $2\frac{1}{2}$ yr.	\$480, 90 da.	$6\times\frac{5}{12}$	$\frac{3}{8}\div\frac{5}{8}$
5.	\$700, 2 yr.	\$200, $1\frac{1}{2}$ yr.	\$1600, 30 da.	$9\times\frac{3}{11}$	$\frac{4}{7}\div\frac{2}{5}$
6.	\$320, 6 mo.	\$630, 30 da.	\$270, 120 da.	$93\times\frac{2}{3}$	$85\div\frac{1}{5}$
7.	\$700, 4 yr.	\$2000, 2 mo.	\$1200, 15 da.	$56\times\frac{3}{7}$	$69\div3$
8.	\$300, $\frac{5}{6}$ yr.	\$1200, $\frac{1}{3}$ yr.	\$2400, 20 da.	$12\times\frac{3}{5}$	$54\div2$

Count the change:

	\$5.00	\$3.00	\$1.00	\$10.00	\$20.00
9.	\$3.46	\$2.37	\$ .38	\$4.37	7.32
10.	\$2.05	\$ .39	\$ .72	\$5.16	9.96
11.	\$ .33	\$1.43	\$ .46	\$6.25	11.14
12.	\$ .68	\$2.26	\$ .54	\$7.10	15.26
13.	\$4.16	\$1.87	\$ .19	\$8.43	18.03

Solve the following:

14.	$\frac{64\times20}{16}$	$\frac{42\times120}{7}$	$\frac{24\times200}{12}$	$\frac{5\times12}{55}$	$\frac{24\times70}{15}$
15.	$\frac{63\times15}{9}$	$\frac{72\times15}{12}$	$\frac{42\times31}{14}$	$\frac{56\times35}{7\times4}$	$\frac{20\times49}{7\times5}$
16.	$\frac{33\times22}{11}$	$\frac{39\times40}{13}$	$\frac{100\times30}{8\times5}$	$\frac{63\times15}{3\times7}$	$\frac{28\times64}{8\times4}$
17.	3.45×10	$.007\times100$	2.2×20	$\frac{8}{7}+\frac{8}{7}$	$\frac{10}{12}\times\frac{36}{35}$
18.	$.026\times10$	$.776\times100$	2.3×30	$\frac{4}{5}+\frac{11}{20}$	$\frac{4}{11}\times\frac{22}{12}$
19.	41.36×10	3.43×100	$.31\times50$	$3\frac{1}{3}+\frac{2}{3}$	$1\frac{1}{12}\times\frac{24}{45}$
20.	$.78\times10$	74.6×100	$8.8\div100$	$1\frac{3}{7}+1\frac{3}{7}$	$\frac{4}{7}\times\frac{42}{20}$
21.	$.013\times10$	607.1×100	$42.6\div100$	$1\frac{1}{3}+\frac{1}{4}$	$\frac{5}{8}\times\frac{32}{35}$
22.	5.80×10	88.47×100	$.843\div100$	$1\frac{1}{2}-\frac{3}{4}$	$1\frac{3}{6}-\frac{5}{6}$
23.	1.06×10	4.163×100	$.46\div100$	$1\frac{3}{4}-\frac{1}{2}$	$1\frac{2}{3}-\frac{2}{3}$

GENERAL WRITTEN PROBLEMS

1. A class of 25 was given an examination in spelling, each boy writing 50 words. Six boys had all the words correct, 7 mispelled 2 words each, and the remaining boys each had 8 words wrong. Find the average per cent of the class.

2. How much will it cost at \$2.80 per gal. to varnish two floors whose dimensions are $18' \times 15'$, if one quart of varnish will cover a space of 150 sq. ft.?

3. What is the total freight charge on 12,250 lb. of machinery at 65¢ per cwt. and 15,670 lb. of hardware at 60¢ per cwt.

4. A mechanic is ordered to make, with tin, a hollow cylinder 25″ high and 8″ in diameter. What are the dimensions of the rectangular sheet of tin he will require?

5. A dealer bought 300 bu. of potatoes at \$.80 a bushel. He lost 20% of them through decay. At what price per bushel must he sell the remainder to gain 25% on the investment?

6. A tank 9′ deep, 14′ long, and $7\frac{1}{2}'$ wide is $\frac{2}{3}$ full of water. At the rate of 5 gal. a minute, how long will it take to pump out the water?

7. A dealer bought 4000 lb. raisins at 16¢, less discounts of 25%, 20%, and 10%. He paid \$3.20 cash for freight. Find what the raisins cost him.

8. A collection agency charges 4% for collecting a debt and remits \$842.88. How much did the agency collect?

9. Calculate the interest and amount at 4% on \$975 for 4 yr. 3 mo., interest compounded semiannually.

10. At 9¢ a sq. yd., what will it cost to paint a reservoir 20′ in diameter and 50′ high?

11. Machinery listed at \$1128 was sold, subject to a discount of 25%, $12\frac{1}{2}$%, and 5%. Find the net price.

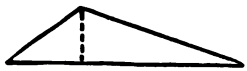
12. A department store manager marks goods $16\frac{2}{3}\%$ above cost. What is the cost of a lamp that he has marked \$21.70?

13. A man owned a house worth \$6000. He insured it for 3 years for 75% of its value, the insurance rate being \$1.50 per thousand a year. How much premium did he pay?

14. A real estate broker had two houses, one costing \$24,500 and the other \$30,000. He was forced to sell the first house at a loss of 50%. What per cent must he gain on the second house to balance the loss on the first?

15. There are 360 persons in an auditorium 60′ long and 40′ wide. To provide 100 cu. ft. of air to each person, how high ought the room to be?

16. Let the area of this figure be 81.65 sq. in. If the base is 28.4 in. in length, find the altitude.



17. What will be the interest on \$835 for 2 yr. 4 mo. 12 da. at 3%?

18. A wire netting is erected around a circular duck pond, the longest distance across which is 100 ft. Find the cost of the netting at 48¢ a yd.

19. A dealer bought 50 arithmetics at 39¢ each and 40 readers at $37\frac{1}{2}$¢ each. At what uniform price must he sell them in order to make a profit of \$8.70 on the whole transaction?

20. There are 231 cu. in. in a gal. How many gallons of gasoline will a cylindrical tank hold if it is $3\frac{1}{2}$ ft. in diameter and 4 ft. high?

21. How many tons of ice can be packed in a space $40' \times 30' \times 20'$, if a cu. ft. of ice weighs $58\frac{1}{2}$ lb.?

22. Make out a bill for the following: 640 yd. taffeta @ \$1.25; 370 yd. velvet @ \$1.45. Discounts 25%, 10%.

ARITHMETIC BY GRADES

EIGHTH YEAR BOOK

SECOND HALF: GRADE 8B

I. PRACTICE WITH NUMBERS

WRITTEN EXERCISE IN ADDITION

Add by rows and by columns. Check results by adding the column totals and then adding the side totals:

1. $5219+6278+4823+4586+4718+8918=$
   $6716+2932+2894+2315+2315+2162=$
   $8650+1654+5614+3275+3275+1705=$
   $6147+1490+5018+6580+6580+4538=$
   $2359+1748+2286+7285+7285+9903=$
   $1828+3997+6665+8869+8869+7015=$
   $6482+4958+7653+7829+1640+2987=$
   $\underline{5635}+\underline{8864}+\underline{3551}+\underline{6935}+\underline{4995}+\underline{8268}=$
   $+\quad+\quad+\quad+\quad+\quad=$

Add horizontally and check:

2. 7, 64, 318, 49, 9, 487, 235, 775, 27, 13, 8.
3. 785, 29, 19, 198, 404, 52, 463, 24, 389, 72.
4. 25, 84, 308, 465, 347, 28, 382, 405, 992, 49.
5. 11, 286, 57, 140, 424, 217, 906, 51, 413, 94.
6. 75, 492, 90, 881, 8, 363, 39, 475, 847, 303, 8.

7. Sales sheet: foot up the daily totals, and also add weekly sales of each clerk, and cast the grand total:

CLERK'S NUMBER	MON.		TUE.		WED.		THURS.		FRI.		SAT.		TOTAL
471	83	13	235	21	423	59	64	22	340	31	219	24	
233	164	87	181	03	222	35	909	23	119	96	243	45	
407	987	56	206	16	313	67	617	21	703	70	154	26	
514	745	23	983	13	607	22	665	23	182	10	159	65	
334	151	47	575	26	159	42	122	99	174	62	241	60	
230	167	59	208	15	636	17	318	02	476	31	482	75	
401	206	36	88	49	309	72	94	83	205	58	190	81	
335	110	50	512	70	131	11	127	32	106	66	228	86	
212	141	57	470	95	987	42	289	60	188	34	150	81	
115	645	26	422	35	902	25	98	97	28	64	330	51	
TOTAL													

WRITTEN EXERCISE IN SUBTRACTION

Subtract the following: check results:

1. \$5480.12 4396.48	**2.** 392000 178858	**3.** 24.003 9.4754	**4.** 612 13.8275
5. \$4369.17 3887.95	**6.** 8.00721 6.23859	**7.** 4.4123 1.0096	**8.** 273.223 84.6756
9. \$3487.10 698.97	**10.** 8462001 347828	**11.** 782812 75928	**12.** 346.1 19.7342

ORAL EXERCISES IN MULTIPLICATION

Multiply:

1. 144×25	**4.** $840 \times 8\frac{1}{3}$	**7.** $744 \times 66\frac{2}{3}$
2. 262×60	**5.** $376 \times 12\frac{1}{2}$	**8.** $648 \times 37\frac{1}{2}$
3. 472×75	**6.** $968 \times 87\frac{1}{2}$	**9.** $672 \times 16\frac{2}{3}$

Find the cost of each of the following items:

10. 462 lb. oolong tea	@	\$.50
11. 872 lb. Mocha coffee	@	.25
12. 72 yd. broadcloth	@	1.66⅔
13. 396 yd. French serge	@	.83⅓
14. 848 yd. flag bunting	@	.37½
15. 264 yd. cotton crêpe	@	.12½
16. 54 lb. pistachio nuts	@	1.50
17. 290 lb. salted almonds	@	.60
18. 24 yd. brocaded satin	@	2.87½
19. 488 yd. cotton corduroy	@	.87½
20. 48 lb. imported cheese	@	2.37½
21. 672 yd. mercerized mull	@	.16⅔
22. 810 lb. fancy chocolates	@	.80
23. 426 yd. lingerie batiste	@	.66⅔
24. 88 doz. jars salmon paste	@	1.12½
25. 544 yd. Irish dress linen	@	.62½
26. 75 doz. cans lunch tongue	@	1.33⅓
27. 64 yd. tablecloth linen	@	1.75
28. 372 yd. kindergarten cloth	@	.33⅓
29. 96 doz. cans vegetable soup	@	1.16⅔
30. 348 lb. candied ginger root	@	.75
31. 396 lb. unsweetened chocolate	@	.40
32. 544 lb. Columbia River salmon	@	.75
33. 745 lb. assorted animal crackers	@	.20

Multiply each number by 10; *by* 100; *by* 1000:

34. 84.3	**39.** 9.812	**44.** 54.96	**49.** 324.12
35. 5.96	**40.** 54.63	**45.** 2000.8	**50.** 907.32
36. 743	**41.** 745.8	**46.** 11.846	**51.** 87.908
37. 2325	**42.** 2.934	**47.** 2.3475	**52.** 7.8436
38. 24.65	**43.** 84.75	**48.** 92.840	**53.** 4567.9

SHORT METHODS OF MULTIPLYING AND DIVIDING

To multiply by:

5, *multiply by* 10 *and divide by* 2.
50, *multiply by* 100 *and divide by* 2.
25, *multiply by* 100 *and divide by* 4.
250, *multiply by* 1000 *and divide by* 4.
125, *multiply by* 1000 *and divide by* 8.
12½, *multiply by* 100 *and divide by* 8.
75, *multiply by* 300 *and divide by* 4.
33⅓, *multiply by* 100 *and divide by* 3.
66⅔, *multiply by* 200 *and divide by* 3.
16⅔, *multiply by* 100 *and divide by* 6.
83⅓, *multiply by* 500 *and divide by* 6.
37½, *multiply by* 300 *and divide by* 8.
62½, *multiply by* 500 *and divide by* 8.
87½, *multiply by* 700 *and divide by* 8.

To divide by:

5, *multiply by* 2 *and divide by* 10.
50, *multiply by* 2 *and divide by* 100.
25, *multiply by* 4 *and divide by* 100.
250, *multiply by* 4 *and divide by* 1000.
125, *multiply by* 8 *and divide by* 1000.
12½, *multiply by* 8 *and divide by* 100.
75, *multiply by* 4 *and divide by* 300.
33⅓, *multiply by* 3 *and divide by* 100.
66⅔, *multiply by* 3 *and divide by* 200.
16⅔, *multiply by* 6 *and divide by* 100.
83⅓, *multiply by* 6 *and divide by* 500.
37½, *multiply by* 8 *and divide by* 300.
62½, *multiply by* 8 *and divide by* 500.
87½, *multiply by* 8 *and divide by* 700.

ORAL EXERCISE IN DIVISION

Divide each number by 10; *by* 100; *by* 1000:

1. 243	5. 527.1	9. 873.2	13. 526.3
2. 90.7	6. 800.3	10. 2491	14. 324.72
3. 48.4	7. 41.17	11. 6807	15. 419.25
4. 7.89	8. 2456	12. 84053	16. 9006.4

Find:

17. $33\frac{1}{3}\%$ of:	264	546	417	2364	4284
18. $16\frac{2}{3}\%$ of:	948	246	3456	4734	8004
19. 25 % of:	312	464	548	804	9144

WRITTEN EXERCISE

Multiply each number by $37\frac{1}{2}$ *and* $87\frac{1}{2}$, *in turn: Divide each number by* $37\frac{1}{2}$ *and* $87\frac{1}{2}$, *in turn:*

1. 344	3. .048	5. 2.16	7. 54.64
2. 654	4. 1.96	6. 6376	8. 48.32

WRITTEN PROBLEMS

1. The total amount of sales recorded by 125 salesmen was $93,562.50. What was the average of these men's sales?

2. A dealer puts in a stock of goods costing $4450. If he spends $306.16 in advertising them and sells them at a profit of $37\frac{1}{2}\%$, how much does he gain?

3. 250 banks reported total deposits of $83,242,203.52. What amount expresses the per bank average?

4. Find the average hourly production of a machine which turned out 6150 cans during a $12\frac{1}{2}$-hour run.

5. Tell the cost of 1472 yards of Axminster carpet at $1.25 a yard.

6. The War Department ordered 48,642 yd. of cotton material at $16\frac{1}{2}¢$ a yard. What was the cost?

REVIEW OF FRACTIONS

ORAL EXERCISE

Find the sum of each set; then the difference; then the product: Divide the first term by the second:

1.	$\frac{1}{2}$ $\frac{1}{3}$	$\frac{1}{5}$ $\frac{1}{2}$	$\frac{4}{5}$ $\frac{2}{3}$	$\frac{1}{7}$ $\frac{1}{8}$	$\frac{8}{9}$ $\frac{3}{7}$
2.	$\frac{2}{7}$ $\frac{3}{6}$	$\frac{8}{9}$ $\frac{7}{8}$	$\frac{7}{9}$ $\frac{2}{7}$	$\frac{9}{10}$ $\frac{1}{2}$	$\frac{3}{5}$ $\frac{2}{3}$
3.	$\frac{5}{8}$ $\frac{1}{2}$	$1\frac{1}{2}$ $\frac{2}{3}$	$\frac{5}{7}$ $\frac{1}{8}$	$1\frac{1}{2}$ $\frac{1}{6}$	$\frac{5}{9}$ $\frac{4}{7}$
4.	$\frac{2}{3}$ $\frac{1}{7}$	$\frac{3}{8}$ $\frac{3}{9}$	$\frac{5}{6}$ $\frac{3}{8}$	$\frac{7}{8}$ $\frac{3}{5}$	$\frac{3}{7}$ $\frac{1}{2}$
5.	$\frac{7}{10}$ $\frac{2}{5}$	$1\frac{5}{2}$ $\frac{3}{7}$	$\frac{7}{8}$ $\frac{2}{5}$	$\frac{2}{3}$ $\frac{3}{4}$	$\frac{9}{10}$ $\frac{4}{5}$
6.	$\frac{4}{5}$ $\frac{5}{6}$	$\frac{3}{4}$ $\frac{5}{8}$	$\frac{1}{6}$ $\frac{1}{9}$	$\frac{2}{5}$ $\frac{1}{2}$	$\frac{6}{7}$ $\frac{1}{2}$

WRITTEN PROBLEMS

1. A mechanic's time card shows that he works as follows: $6\frac{3}{4}$ hr., $7\frac{1}{2}$ hr., 8 hr., $7\frac{3}{4}$ hr., $4\frac{3}{4}$ hr., $5\frac{1}{4}$ hr. What is his weekly pay at 44¢ an hour?

2. Find the cost of the following: 8 lb. sugar @ 10¢ a lb.; $1\frac{1}{2}$ lb. meat at 26¢ a lb.; $2\frac{3}{4}$ lb. butter at 48¢ a lb.; $1\frac{1}{2}$ doz. eggs at 42¢ a doz.

3. A dealer paid $1.60 a bushel for potatoes and sold them at 55¢ a peck. Find his gain on $48\frac{1}{2}$ bushels.

4. A clerk earned $660 a year for a period of two years, and $\frac{4}{11}$ more the third year, saving $\frac{3}{20}$ of his salary each year. How much did he save in the three years?

5. A lady has three pieces of ribbon: one, $\frac{1}{2}$ yd. long; another, $1\frac{7}{8}$ yd. long; and the third, $\frac{7}{8}$ yd. long. How much more ribbon will she have to buy to have 5 yd.?

6. In $2\frac{3}{4}$ hours a boy rides $23\frac{3}{8}$ miles on a bicycle. What is his average rate per hour?

7. How many towels $\frac{1}{2}$ yd. long can be cut from $10\frac{1}{4}$ yd. of material? What part of a yd. will be left?

8. If $\frac{5}{4}$ of a pound of butter cost $\$\frac{3}{5}$, what will $5\frac{1}{4}$ pounds cost?

9. $\frac{1}{3}$ of the length of a bolt runs through steel, $\frac{2}{15}$ through cement, and the rest through wood. What part runs through the wood?

10. A farmer owning $47\frac{5}{8}$ acres of land sells $7\frac{1}{3}$ acres to A, and $24\frac{5}{8}$ acres to B. How many acres has he left?

11. If one gallon of oil weighs $7\frac{3}{4}$ lb., how many gallons does a tank contain whose capacity is 55,025 lb.?

12. In a mail of 100 pounds there are 800 letters that average 20 letters to the pound. The remainder of the mail is of papers that average 10 to the pound. How many papers are there?

13. Seven boys picked together 16 bu. 2 pk. 3 qt. of berries and sold them at 8¢ per qt. What was each boy's share?

14. If a farmer pays $\frac{1}{12}$ of his grain for the grinding, how much must he take to the mill in order to bring home 16 bu. 2 pk.?

15. An investor, who owned $\frac{5}{8}$ of a silver mine, sold $\frac{3}{4}$ of his share for $1710. What was the value of the mine?

16. A man left an estate of $150,240. He willed $\frac{1}{3}$ of it to his wife, $\frac{1}{8}$ to each of his three daughters, $\frac{1}{4}$ to his son, and $\frac{1}{2}$ of the remainder to each of his two grandchildren. How much did each of his grandchildren receive?

17. A tank measuring $24' \times 8' \times 10'$ is half full of water. If a cubic foot of water weighs $62\frac{1}{2}$ lb., what is the weight of the water in tons?

18. How many pieces, each 2.25 yd. in length, can be cut from 26.25 yd. of wire, and how many yd. will be left?

19. At 15¢ a bushel, calculate the cost of enough cotton seed to plant 242.4 acres, if each acre requires 1.75 bushels.

20. How many lengths $1\frac{1}{4}$ yd. long can be cut from $4\frac{3}{8}$ yd.?

21. A naval vessel makes the following record in 5 hours: first hour, 24.6 mi.; second hour, 25.75 mi.; third hour, 25.875 mi.; fourth hour, 26.25 mi.; fifth hour, 26.4 mi. Determine the hourly average.

22. A man who owes a debt of \$159.50, plans to work off the indebtedness by day's labor. If his wage is $\$2\frac{3}{4}$ a day, how many days will he have to work?

23. A gas meter reads 67,300 cu. ft. If the previous reading was 64,900 cu. ft. and the charge is \$1.35 per 1000 cu. ft., tell the amount of the gas bill.

24. A speedometer on an automobile reads 896.4 at the beginning of a trip and 1141.5 at the end. If the trip was made in 9.5 hours, record the average distance per hour.

25. A boy gives the grocer \$5 to pay for 4 lb. of tea at $62\frac{1}{2}$¢ a lb., and $5\frac{1}{2}$ lb. of crackers at 12¢ a lb. What change should he receive?

26. A man bought 8 bu. berries for \$20.56 and lost 24 qt. by decay. He sold the rest for $12\frac{1}{2}$¢ a qt. Did he gain or lose, and how much?

27. A farmer raised 27.5 acres of turnips that averaged 9.81 tons to the acre. If he sold the turnips at \$8.80 a ton, how much money should he have received?

28. A dealer sold 820 tons of coal at \$5.75 a ton. Report the profit on the sale if the coal cost \$4.90 a ton and the selling expenses were \$.25 a ton.

29. An agent bought 439 books at \$3.75 each. He sold them for \$4.90 each, but failed to collect for 19 books. His expenses were \$195. How much did he gain or lose?

30. If .125 of an acre of land is worth $\$15.87\frac{1}{2}$, how much are 25.43 acres worth?

31. If 450 bbl. of beef sold for \$5872.50, what was the selling price for 100 bbl.?

II. REVIEW OF APPLICATIONS OF PERCENTAGE

1. Ten years ago flour cost \$4.70 a bbl.; if today it costs \$7.50, what has been the per cent of increase?

2. A steer weighing 1300 lb. lost 45% of its live weight in slaughtering. Find the value of the beef and the by-products at \$18.40 per average hundredweight.

3. There are 2400 pupils in attendance in a school. This is just 96% of the pupils on register. How many pupils are on register?

4. A salesman working on a $2\frac{1}{2}\%$ commission sells 3 cases of shoes, each containing 36 pairs, at \$.92 a pair; and 2 cases, each containing 24 pairs, at $\$1.37\frac{1}{2}$ a pair. Figure his total commission.

5. A laborer receives today \$27.50 as weekly wages; fifty years ago he would have received \$14.83. By what per cent have his wages increased?

6. The operating expenses of a factory are $37\frac{1}{2}\%$ of the sales. If the sales for a year amount to \$650,450, how much are the operating expenses?

7. A storekeeper receives 15% discount for paying his gas bills promptly. Last month he paid \$17. What was the face amount of the bill?

8. If a dressmaker is allowed $12\frac{1}{2}\%$ discount on goods purchased, what must she pay for $7\frac{1}{2}$ yd. serge at \$2.24 per yd.?

9. A milliner buys hats for \$5.20 per dozen and trims them at a cost of \$1.10 each. At what price must she sell them to have a profit of 50%?

10. A grocer bought 625 doz. pound packages of breakfast food for \$900, less $16\frac{2}{3}\%$ discount. He sold them at 16¢ a package. How much did he gain in all?

11. A man borrowed \$540.75 at $5\frac{1}{2}\%$ interest on Sept. 1, 1918. What amount must he pay on Nov. 15, 1919?

12. Figure the amount of a note for \$640.50 dated April 9, 1918, and paid June 7, 1919, with interest at 5%.

13. One case of candy contains 105 pieces and sells for \$4.20 wholesale. The dealer sells the candy at 5¢ a cake. Find his per cent of profit. How much does he make on the case?

14. A manufacturer sells to a jobber a pair of shoes for \$1.70; the jobber sells them to the retailer at \$1.95; the retailer charges the customer \$2.50. Find the jobber's per cent of profit; also the retailer's per cent of profit.

15. By what per cent does the retailer's price exceed the manufacturer's price in Ex. **14**?

16. A manager sold a 60-yd. piece of cloth at an advance of \$32.40, thereby making a gain of 45%. State the selling price per yard.

17. An agent sold a tug boat for \$20,000. Find his commission at 5% on the first \$2000; $2\frac{1}{2}\%$ on \$8000; $1\frac{1}{4}\%$ on the remainder.

18. A collector succeeded in securing 60% of a debt of \$4600, on which he charged a commission of 5%. How much did he remit to the creditor?

19. A purchasing agent buys 42 stoves at \$17.50. If his commission is 4% and he pays \$9.35 for cartage, what should be remitted to him?

20. Find the net proceeds on a sale of 276 bbl. flour at \$5.50, commission $3\frac{1}{2}\%$, freight and storage charges 30¢ a bbl.

21. If you bought a bill of goods amounting to \$25, with 25% and 50% off for cash, what would be the net amount of the bill?

22. Which is better, and how much: to accept, in buying goods listed at \$600, a single discount of 45%, or discounts of 35%, 10%, and 5%?

23. Chairs listed at \$8.40 are bought at discounts of 20% and 5%, and sold at 10% above their list price. What is the per cent of profit?

24. A furniture buyer orders the following price reductions for a sale: tables \$22.25, reduced 8%; cabinets at \$14.50, 20%; desks at \$16.40, 12½%; bedsteads at \$15.40, 40%. Ascertain the selling price of each article.

25. A dealer bought clothing worth \$1420 on 90 days time. Being offered 5% discount for cash, he borrowed the money for 90 days at 6% per annum, and paid the bill at once. How much did he save in this way?

26. A commission agent charged \$49.20 for buying 240 lamps, at \$8.20 each. Tell his rate of commission.

27. What is the interest on \$840 for 13 mo. at 6%?

Find the interest at 6% on:

28. \$560 for 1 mo. 15 da.

29. \$720 for 8 mo. 15. da.

30. \$840.50 for 5 mo. 10 da.

31. \$3000 for 2 yr. 3 mo.

32. \$1500 for 1 yr. 6 mo. 10 da.

33. \$4200 for 3 yr. 2 mo.

34. A man borrowed \$250 on January 15 at 6%. What amount did he pay on October 15?

Find the interest for 1 yr. 3 mo. 10 da. on:

35. \$560, at 6%

36. \$210, at 4%

37. \$90, at 3%

38. \$800, at 5%

39. \$340, at 6%

40. \$1800, at 4%

41. A cubic foot of water weighs 62.5 lb. and a cubic foot of cast iron weighs 450 lb. What per cent of the weight of cast iron is the weight of water? What per cent of the weight of water is the weight of cast iron?

42. A department store was forced to sell a carpet for \$42.50, at a loss of 15%. How much had the carpet cost?

43. An investor secures the use of \$26,500 for 90 da. at 5%. Find the amount he pays at the end of this time.

44. 6% is charged on a loan of \$450 for 1 yr. 3 mo. 20 da. Calculate the interest and the amount.

45. On Jan. 1 a man borrowed \$500 at 5% interest. On March 15 he borrowed \$420 more at the same rate. What amount will he pay if he settles both loans on May 15?

46. At what rate will \$100 in 3 years yield an interest of \$13.50?

47. A savings bank pays 4% interest. How much has a man on deposit who receives for one year \$260.56 interest?

48. A certain grade of candy is imported at a cost of 34¢ a box. If the duty is 25%, for how much must the importer sell each box to clear $33\frac{1}{3}$% profit?

49. Hair brushes for which we pay 97¢, are worth 60¢ on shipboard. The duty is 35% ad valorem. Find the retailer's profit on each brush sold.

50. A shipment of 3780 lb. of woolen yarns, at an average value of 32¢ per pound, is dutiable @ 18%. Ascertain the total cost of the shipment including the duty.

51. A dealer imported 800 yd. of silk at \$1.20 per yd. He paid 25% ad valorem duty and 25¢ per yd. specific duty. In order to gain 25% profit, at what price must he sell the goods in America?

52. What premium will insure the value of 600 bbl. of flour worth \$5.80 a bbl., if the rate is $\frac{3}{4}$%?

Record the term of discount, the bank discount, and the proceeds of the following notes:

53. A note for \$735 dated Sept. 21, 1918, time 90 da.; discounted Oct. 9, 1918, at $4\frac{1}{2}$%.

54. A note for 60 da. for \$5000, dated Jan. 3, 1919, and discounted Feb. 10, 1919, at 5%.

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	70% of 130	200% of 117	5.469×100	$\frac{3}{5} \times \frac{2}{3}$	24.13×10
2.	3% of 81	$87\frac{1}{2}\%$ of 480	$.0124 \times 100$	$\frac{7}{10} \times \frac{1}{2}$	21.42×10
3.	8% of 112	10 % of 6000	246.5×100	$\frac{14}{15} \times \frac{3}{7}$	4.21×10
4.	40% of 250	60 % of 1500	37.14×100	$\frac{7}{20} \times \frac{3}{5}$	5.783×10
5.	90% of 220	$83\frac{1}{3}\%$ of 1200	6.011×100	$\frac{11}{12} \times \frac{1}{3}$	$.3169 \times 10$
6.	$8\frac{1}{3}\%$ of 600	$62\frac{1}{2}\%$ of 1600	38.27×100	$\frac{4}{9} \times \frac{1}{2}$	937.2×10
7.	$12\frac{1}{2}\%$ of 800	$54.30 + .90$	$27.30 - 5.40$	$1\frac{3}{8} + \frac{3}{16}$	$.15 \div 100$
8.	$16\frac{2}{3}\%$ of 660	$67.40 + .70$	$31.20 - 2.30$	$3\frac{5}{9} + \frac{2}{3}$	$3.8 \div 100$
9.	$37\frac{1}{2}\%$ of 320	$73.90 + .50$	$43.50 - 4.60$	$2\frac{7}{8} + \frac{3}{16}$	$.43 \div 100$
10.	$87\frac{1}{2}\%$ of 480	$81.80 + .60$	$59.10 - 1.20$	$9\frac{1}{10} + \frac{4}{5}$	$1.1 \div 100$
11.	$66\frac{2}{3}\%$ of 930	$95.40 + .80$	$63.40 - 2.50$	$4\frac{3}{7} + \frac{5}{21}$	$19 \div 100$
12.	250% of 200	$73.21 + .32$	$79.20 - 3.30$	$7\frac{4}{9} + \frac{1}{3}$	$2.2 \div 100$
13.	75% of 440	125% of 600	$95 \div 15$	$4\frac{7}{9} - \frac{2}{3}$	$.349 \div 10$
14.	2% of 840	17% of 300	$85 \div 17$	$3\frac{6}{10} - \frac{1}{2}$	$67.2 \div 10$
15.	1% of 1413	$33\frac{1}{3}\%$ of 696	$67 \div 19$	$7\frac{7}{12} - \frac{2}{3}$	$8.25 \div 10$
16.	$11\frac{1}{9}\%$ of 630	$14\frac{2}{7}\%$ of 721	$90 \div 18$	$1\frac{5}{16} - \frac{5}{8}$	$164 \div 10$
17.	$66\frac{2}{3}\%$ of 975	$11\frac{1}{9}\%$ of 981	$96 \div 16$	$5\frac{6}{22} - \frac{2}{11}$	$.945 \div 10$

Change to common fractions:

18.	15%	$6\frac{1}{4}\%$	$11\frac{1}{9}\%$	.12	$66\frac{2}{3}\%$
19.	45%	35%	30 %	.16	$12\frac{1}{2}\%$
20.	5%	4%	65 %	.45	$62\frac{1}{2}\%$
21.	8%	55%	$83\frac{1}{3}\%$	.625	$87\frac{1}{2}\%$
22.	75%	$8\frac{1}{3}\%$	90 %	.0625	$14\frac{2}{7}\%$

	Of what number is:			*Solve:*	
23.	14, 20%?	54, 10 %?	24, 80%?	$4\frac{1}{2} \div \frac{1}{8}$	$90 \div 18$
24.	30, 75%?	17, $33\frac{1}{3}\%$?	16, 25%?	$3\frac{1}{3} \div \frac{2}{9}$	$68 \div 17$
25.	12, $37\frac{1}{2}\%$?	90, $12\frac{1}{2}\%$?	9, 300%?	$2\frac{3}{4} \div \frac{1}{2}$	$75 \div 15$
26.	40, $66\frac{2}{3}\%$?	26, 50 %?	45, $83\frac{1}{3}\%$?	$6\frac{5}{9} \div \frac{2}{3}$	$92 \div 23$
27.	24, 200%?	25, $62\frac{1}{2}\%$?	22, $16\frac{2}{3}\%$?	$4\frac{1}{10} \div \frac{3}{5}$	$76 \div 19$

GENERAL WRITTEN PROBLEMS

1. What is the difference in the per cent of attendance between two classes, one of which has 42 on roll and 3 absent, the other 48 on roll and 4 absent?

2. A grocer bought 28 bbl. of flour at \$4.90 a bbl. He sold $\frac{3}{7}$ of it at 3¢ a lb. and the remainder at $3\frac{1}{4}$¢. How much did he gain or lose?

3. A factory employing 200 girls discharged 50 of them on account of poor business. If each girl earned \$9 a week, by what per cent was the weekly pay roll reduced?

4. Mr. Evans borrowed \$2250 from a loan association. The rate of interest was 6%, and the agent charged 1% commission. If Mr. Evans kept the money 2 years and 6 months, how much did the loan cost him?

5. A man bought a cart for \$10. He spent \$1.75 to have it repaired and \$1 to have it painted. He then sold the cart for \$18. What per cent did he gain on the cost?

6. A house that cost \$5000 drawn from a savings bank paying 4% interest annually, rents for \$45 a month. The owner pays 2% on $\frac{3}{5}$ of its value in taxes and \$30 a year for repairs. What per cent profit does the house pay?

7. There are 19 pupils in a class and each needs $3\frac{1}{2}$ cups of hot water for a cooking lesson. How much water must there be in a kettle to supply all the class at one time allowing 4 cups to the quart?

8. Our gymnasium is 44 feet wide and 120 feet long. About how many times would you have to go around the gymnasium to do a mile, keeping three feet away from the walls?

9. If a tree $20\frac{2}{3}$ ft. high casts a shadow 13 ft. long, how high is a tree that casts, at the same time, a shadow 78 ft. long?

10. The tank of a sprinkling wagon is 7 ft. long and $3\frac{1}{2}$ ft. in diameter. How many gal. of water does it hold?

11. In a certain mail there are 294 lb. 14 oz. of newspapers weighing at the rate of 3 papers to 7 oz. How many papers are there in the mail?

12. A clerk had an income of \$840 a year. He spent $\frac{1}{7}$ of it for supplies on credit. Had he paid cash, 83¢ would have bought \$1 worth of the goods as billed. How much would he have saved by paying cash?

13. John Ferguson bought of Baker & Co.: 350 lb. nails @ $3\frac{1}{2}$¢ per lb.; 7 hammers @ \$.79; 4 doz. sleds @ \$18.25 per doz.; and 5 doz. lawn mowers at \$35.20 per doz. Make out the bill and receipt it.

14. An agent received \$4800.20 with which to buy flour at \$5.50 a bbl. After paying a \$200 freight bill and his commission of 2%, how many barrels did he buy?

15. One fourth of a full barrel of oil had been sold to A. Then B bought 12 gal., after which the barrel was found to be half full. How many gal. did it contain at first?

16. In going around a fountain in a park, a boy walks $\frac{5}{8}$ of a mile. What is the diameter of the base of the fountain?

17. Three men formed a partnership to sell fruit; the first investing \$48, the second \$60, and the third \$72. If they gained \$60 the first week, what was each partner's share of the profit?

18. A bicycle wheel is 35 inches in diameter. How many times will the wheel turn in going 20 rods?

19. Find the interest on \$568 for 1 yr. 8 mo. 12 da. at 6%.

20. How many feet of wire fencing are required to fence a garden 52 yd. long and 23 yd. wide?

21. How much taxes must a man pay on a piece of property worth \$9675, if the tax rate is \$13 per hundred?

III. MONEY: BANKS AND BANKING

Kinds of Banks. Banks may be divided into two large groups: *commercial banks* and *savings banks.*

Commercial banks take care of the great sums of money needed to carry on the business affairs of the country; they are called **banks of deposit**, also, because money is deposited with them by their customers, to be drawn out by check at convenience. Commercial banks make collections, and lend in various ways, the money received from depositors, as by "buying" notes at a discount. As a rule these banks do not pay interest on the deposits. Some commercial banks do pay interest on deposits that are continued in bank not less than a stated length of time. Commercial banks include federal reserve banks, national banks, and state banks. They make their profit by charging interest on the loans of various sorts which, as stated above, they negotiate, using the money of the depositors.

Savings banks take care of money left on deposit for periods not shorter, generally, than six months, to earn interest. The law permits them to receive but small sums, usually not over $1000 per person. They ordinarily pay interest at $3\frac{1}{2}\%$ or 4%, compounded semiannually.

A **trust company** is another kind of bank authorized under state law. It also receives deposits and makes loans, but in addition it does other business such as caring for and investing money held in trust, looking after estates and properties, and executing the terms of the wills of deceased persons. The trust company usually pays interest on deposits and the money deposited may be drawn upon by check.

A Bank Account. To deposit money in a bank, a person fills out a **deposit slip,** such as the one pictured on this page, and hands the money and the checks with the slip to the bank's receiving teller. He also hands the teller the small **pass book,** or account book. The teller, having seen that the entries on the deposit slip are correct, and that the checks, if any, are properly made out and indorsed, enters the amount of the deposit in the pass book, writing his initials on the same line (as shown at right in the illustration representing a page from a depositor's book).

DEPOSITED BY

John J. Coleman

Oct. 9, 1918

IN

The Franklin Trust Co.

		DOLLARS	CENTS
GOLD			
SILVER		*2*	*35*
BILLS		*55*	
CHECKS	*Corn Exchange Bank*	*13*	*86*
"	*Hudson Trust Co.*	*130*	
"	*Merchant's Nat'l*	*25*	
		226	*21*

Jan.	*16*	BALANCE	*872*	*35*
Jan.	*21*	*N.*	*110*	
	25	*B.*	*70*	*10*
Feb.	*2*	*N.*	*185*	*64*
	11	*M.*	*43*	*10*
	14	*B.*	*168*	*65*
		TOTAL CREDITS	*1449*	*84*
LESS	*28*	Vouchers Ret'd	*618*	*68*
		Per List		
Feb.	*16*	BALANCE	*831*	*16*

At least once a month the depositor should leave his pass book at the bank to have it balanced and to receive the canceled checks the amount of which the bank has paid from his account during the month. These checks are called **vouchers.** Since the payee's name is on the back of each check, these vouchers serve as receipts.

WRITTEN EXERCISE

Make and fill out deposit slips, supplying names of depositors and banks:

1. Silver, $44.58; bills, $412; checks on Colonial Trust Company, $8.50; First National, $100,515, $825.

2. Silver, $101.26; bills, $745; checks on New Amsterdam Bank, $1458.26; Gordon Trust Company, $588.95; Lenox State Bank, $800; Merchants National Bank, $645.80.

3. Gold, $250; silver, $13.25; checks on Mercantile Bank, $675.75; Corn Exchange, $550.82; Empire Trust Company, $25, $1114.25; Bank of Long Island, $790.54.

4. Bills, $914; checks on Hanover National Bank, $327.14; Produce Exchange Bank, $971.50, $1197.30, $4000.

5. Gold, $410; silver, $311.96; bills, $1465; checks on Second National Bank, $803.39; Fifth Avenue Bank, $6415.22; Drovers Bank, $55.85.

6. Silver, $346.19; bills, $984; checks on Riverside Trust Company, $125.60; Gary National Bank, $405.83, $748.16, $1008.93; State Bank of Chicago, $325.44.

Using the following dates and deposits, draw up extracts from bank account books following the model given. Find the balance in each case:

7. Feb. 16, balance, $831.16; Feb. 19, $346.47; Feb. 28, $196.17; Mar. 2, $439.73; Mar. 11, $750.37; Mar. 13, $1013.25; Mar. 15, $258.83. Vouchers returned Mar. 16, $2746.93.

8. Aug. 3, balance, $39.95; Aug. 8, $423.97; Aug. 11, $2037.39; Aug. 20, $587.36; Aug. 22, $643.31; Aug. 30, $1117.12; Sept. 4, $547.31. Vouchers returned Sept. 10, $4732.12.

9. Dec. 4, balance, $417.25; Dec. 7, $2246.54; Dec. 10, $837.46; Dec. 15, $1003.35; Dec. 21, $946.37; Dec. 22, $471.23; Dec. 26, $338.47. Vouchers returned, Jan. 2, $4589.98.

10. Apr. 28, balance, $222.56; Apr. 29, $331.13; May. 3, $847.36; May 9, $801.26; June 16, $36.61; June 18, $414.39; June 20, $1473.86. Vouchers returned, June 26, $2166.54.

Checks. When a man opens an account with a bank, he receives among other things a check book containing blank checks to be used when he wishes to draw out money. A **check** is an order on a bank, signed by a depositor, to pay a certain sum from the depositor's balance. In this check

No.----1213----------	*No. --1213--* *Albany,---Aug. 3, 1919---*
Date----Aug. 3, 1918-----	SECOND NATIONAL BANK OF ALBANY
Pay to---Robert S. Strong	*Pay to-----Robert S. Strong----------or order*
For---Rent----------	*One hundred Twenty-five and $\frac{60}{100}$ ~~~~~ Dollars*
Amount---$125.50-------	*$125.50* *-------Henry Taylor.-------*

the depositor, Henry Taylor, is the **drawer**, and Robert S. Strong, the **payee**. To cash this check or to deposit it in his bank, Mr. Strong must **indorse** it on the back. Checks may also be drawn to " Bearer," to " Cash," or to " Self." A check drawn to " Bearer " or to " Cash " requires no indorsement by the maker and is payable to any one presenting it, though that person may be asked at the bank to indorse it as a matter of record. If the depositor draws a check to " Self," he must indorse it to secure the money. Notice that the **stub** left in the check book gives a complete record of the payment.

WRITTEN EXERCISE

Draw the following checks and fill out the stubs, supplying the necessary details:

1. $496.17, on Philadelphia Trust Company; Henry L. Paton, maker, Everett L. Dodge, payee.

2. $85.25, on Chemical National; Cyrus Budd, maker, John Dunn, payee.

3. $945.10, on Union Exchange Bank; Bertram H. Cohn, maker, Harriet Cook, payee.

4. Robert S. Strong's balance was $237.40. He deposited $47.96, $353, $876.49, $1110.25, $37.46, $120.25, and paid by check a rent bill of $740, and a bill for goods at $445.50 less 3%, and a bill for $631.10 less 5%. Write up his present balance.

The Postal Savings System. Any person 10 years old or over may deposit any number of dollars up to and including $1000 at any United States post office. Certificates are issued for $1, $2, $5, $10, $20, $50, $100, $200, and $500. No one is allowed to have on deposit at any one time more than $1000, exclusive of accumulated interest.

Interest at 2% is paid annually. No interest is paid for fractional parts of a year, but each deposit begins to draw interest on the first day of the month following the deposit. Deposits may be withdrawn on demand together with the accrued interest.

WRITTEN EXERCISE

Compute the interest due on these postal savings deposits:

1. $14 for 2 yr.
2. $59 for 3 yr.
3. $67 for 5 yr.
4. $ 75 for 3 yr.
5. $ 83 for 4 yr.
6. $108 for 6 yr.
7. $224 for 2 yr.
8. $350 for 1 yr.
9. $425 for 5 yr.

BANK DISCOUNT

Borrowing Money. We have seen that commercial banks have from both their own capital and the balance of depositors, much money on hand which they are able to lend out to business men. They lend this money for the most part on promissory notes. These are, in the majority of instances, notes received by depositors from their debtors in payment, ordinarily, for goods purchased.

We have seen also that when one person or firm accepts a promissory note from another, the maker of the note is expected to pay the interest when the note comes due. When a bank, however, accepts a promissory note by loaning money on it, it is said to **discount** the note; that is, the bank requires that the interest be paid in advance. This interest paid in advance is called **bank discount.**

1020\frac{00}{100}$ ***Buffalo, N. Y.,*** *Sept. 5,* ***1918.***

Sixty days ***after date, for value received, I promise to pay to the order of*** *George H. Hickey* *One thousand twenty* $\frac{00}{100}$ ***Dollars,*** ***at*** **The Traders National Bank.**

Ely M. Behar

If this note is discounted at a bank on the day that it is made, at the rate of 6%, how much will be charged as bank discount? How much will Ely M. Behar receive as the **proceeds**? The *number of days* from the time a note is discounted to the time when it matures, is the **term of discount.** If this note had been discounted on October 1, 1918, what would have been the term of discount?

WRITTEN EXERCISE

1. Name the date of maturity, tell the term of discount, and compute the bank discount and the proceeds of Mr. Behar's note, if discounted Sept. 25, 1918, at 6%.

Date of maturity is Sept. 5, 1918, +60 da., or Nov. 4, 1918.
The term of discount is from Sept. 25, 1918, to Nov. 4, 1918, or 40 da.
The bank discount is the interest on $1020 for 40 da. at 6%, or $6.80.
The proceeds are $1020 − $6.80, or $1013.20.

Find the discount and the proceeds of the following notes:

	FACE	DATE	TIME	DISCOUNTED	RATE
2.	$580	Dec. 4	4 mo.	Dec. 4	6%
3.	$12000	Nov. 6	30 da.	Nov. 6	4%
4.	$5000	Jan. 2	60 da.	Feb. 11	5%
5.	$4000	Sept. 5	3 mo.	Oct. 6	6%
6.	$735	Oct. 21	90 da.	Nov. 20	4½%
7.	$2000	July 3	60 da.	July 13	5%
8.	$1800	Oct. 7	2 mo.	Oct. 21	6%
9.	$920	Feb. 18	90 da.	Mar. 31	5%

10. Write out a 90-day note for $1500, dated Aug. 8, 1917, payable to Elliot Fry's order. Discount it August 18, 1917, at 5%. State proceeds.

11. A note for $95 dated May 4 and due in 100 days was discounted July 8 at 4%. Find the proceeds.

12. A 6-mo. note for $4500 dated Mar. 10, was discounted at 6% on July 12. Find the proceeds.

13. Make out a 60-day note for $450, dated June 15, 1919, payable to H. I. Kleet's order. Discount it July 5, 1919, at 5%. State the proceeds.

14. What are the net proceeds of a note for $860 dated August 9, 1919, for 4 months and discounted September 26, 1919, at 6%?

WRITTEN EXERCISE

1. Compute the bank discount and proceeds of Mr. Behar's note (page 102) with interest at 5%, if it was discounted on Oct. 5, 1918, @ 6%.

The interest at date of maturity, Nov. 4, 1918, is \$8.50.
The amount due at maturity is \$1028.50.
The bank discount is the interest on \$1028.50 at 6% for 30 da., or \$5.14.
The proceeds are \$1028.50 − \$5.14, or \$1023.36.

Compute the bank discount and the proceeds of the following notes, each bearing interest at 6%, and discounted the day it was made:

	FACE	TIME	DISCOUNT		FACE	TIME	DISCOUNT
2.	\$820	60 da.	6%	7.	\$2000	90 da.	6%
3.	\$1200	45 da.	5%	8.	\$1100	60 da.	5%
4.	\$340	30 da.	4%	9.	\$1800	120 da.	6%
5.	\$650	15 da.	6%	10.	\$3000	30 da.	6%
6.	\$900	60 da.	5%	11.	\$2200	90 da.	4%

Find the bank discount and the proceeds of the following notes:

	FACE	DATE		TIME	INTEREST	DISCOUNTED	DISCOUNT
12.	\$300	Jan.	4	90 da.	6%	Feb. 13	6%
13.	\$620	June	26	5 mo.	5%	Aug. 18	4%
14.	\$800	Aug.	9	60 da.	5%	Sept. 8	6%
15.	\$1200	May	15	3 mo.	5%	June 1	5%
16.	\$2200	May	10	7 mo.	5%	Sept. 11	6%
17.	\$3000	Aug.	1	2 mo.	6%	Aug. 12	6%
18.	\$3600	Oct.	1	4 mo.	6%	Oct. 4	6%
19.	\$1000	Jan.	31	30 da.	4%	Feb. 6	6%
20.	\$4000	Mar.	31	60 da.	5%	Apr. 15	5%
21.	\$4500	Feb.	10	4 mo.	4%	Mar. 25	5%
22.	\$4850	Apr.	5	90 da.	6%	June 15	5%

23. On Mar. 18, 1918, John Jones bought a house from William James, giving in part payment a 60-day note for $3400 bearing interest at 5%. On April 5, 1918, William James took the note to his bank and had it discounted at 6%. How much did the bank pay him?

24. Make out a 3-mo. note for $1800, with interest at 4%, dated June 16, payable to Dudley Fields or order, at some bank. Discount it July 28, at 6%. Tell proceeds.

25. For what amount must a note which bears interest at 6% be made out so that it will amount to $560 in two years?

26. At a discount of 5% a note for 90 days yielded as proceeds $888.75. Find the face of the note.

27. For what sum must a 60-day note be drawn, the proceeds of which when discounted at 6% will pay for 300 bbl. apples at $3.30 a barrel?

28. The proceeds of a note for $6000, due April 12, 1916, and discounted at 6% were $5920. When was it discounted?

EXCHANGE

Exchange is a term given to the system by which business men in different parts of the country pay their debts without the transmission of actual money.

Ways of Transmitting Payments. If a business man in Savannah wishes to pay a bill he owes to a New York clothing manufacturer, but without transmitting actual money, he can pay his debt by sending him (1) a check, (2) a postal money order, (3) an express money order, (4) a telegraphic money order, or (5) a bank draft.

Payments by Check. If he mails a check, the payee in New York deposits it in his bank and this bank collects from the Savannah bank on which it was drawn. Sometimes

the collecting bank charges the payee a small fee for the trouble and expense of effecting the exchange.

Payment by Postal Money Order. This is a written order drawn by the postmaster in one place on the postmaster in another place to pay there a specified sum to a certain person. The rates charged by the U. S. Government for domestic money orders are:

$2.50 or less	3¢	$30.01 to $40	15¢
$2.51 to $5	5¢	$40.01 to $50	18¢
$5.01 to $10	8¢	$50.01 to $60	20¢
$10.01 to $20	10¢	$60.01 to $75	25¢
$20.01 to $30	12¢	$75.01 to $100	30¢

The postal money order is " bought " at a post office by the person desiring to transmit payment, and is sent to the person to whom the money is to be paid. He presents it for payment at the designated post office or at a near-by bank. The largest amount for which a single postal money order may be obtained is $100.

Payment by Express Money Order. Express money orders are very similar to postal money orders, and the rates charged are the same. They are written orders of an express company agent directing another agent to pay a certain sum to a specified person. $100 is the largest amount that may be purchased in a single order.

Telegraphic Money Order. A telegraph agent will send an order by telegraph to an agent at another place directing him to pay a certain sum to the person named in the telegram. In addition to the regular charge for a 15-word message, the charges for the exchange are:

For $25 or less	25¢
Over $25 and not over $50	35¢
Over $50 and not over $75	60¢
Over $75 and not over $100	85¢

ORAL EXERCISE

State the cost of postal or express money orders for:

1. $90	4. $7.40	7. $38.14	10. $69.70
2. $1.10	5. $2.80	8. $54.60	11. $34.10
3. $3.45	6. $9.62	9. $65.10	12. $18.85

Bank Drafts. A bank draft is simply a check drawn by the cashier of one bank on another bank.

No. 2425

EMPIRE EXCHANGE BANK
OF BUFFALO

Buffalo, N. Y., Aug. 10, 1918.

Pay to the order of ....*Roswell E. Branson*.....*$730.00*

Seven hundred thirty $\frac{00}{100}$ ~~~

WRITTEN PROBLEMS

1. Find the cost of a draft for \$850 at $\frac{1}{5}\%$ premium.

Compute to the nearest cent, the cost of a draft for:

2. \$250 at $\frac{1}{10}\%$ premium
3. \$1400 at $\frac{1}{4}\%$ premium
4. \$1500 at $\frac{1}{5}\%$ premium
5. \$2200 at $\frac{1}{4}\%$ premium
6. \$3600 at $\frac{1}{8}\%$ premium
7. \$45600 at $\frac{1}{15}\%$ premium

8. How much must I pay for a draft on St. Louis for \$7500 at a premium of 30¢ per \$1000?

9. Find the cost of a bank draft for \$768.54 at 50¢ per \$1000 premium.

10. A purchasing agent buying mules sends drafts to different dealers for \$850, \$2400, \$2850, \$940, and \$1250. How much will drafts for these amounts cost at .1% premium?

11. A merchant had to pay \$1131.13 for a draft, the premium being $\frac{1}{10}\%$. Find the face of the draft and the premium.

12. Write a bank draft using the following data: your address and the current date; drawer, Chase National Bank; drawee, First National Bank, New York; amount, \$850; payee, F. E. Hall; cashier, your name. How large a check will pay for the draft at $\frac{1}{10}\%$ premium? Write the check.

13. A draft cost a dealer \$3501.05, including the premium of 30¢ per \$1000. What was the face of the draft?

14. A merchant secured drafts for \$1280, \$2560, and \$4400, all at $\frac{1}{4}\%$ premium. He drew one check for the three drafts. Find the amount of the check.

15. The Paragon Tailoring Company draws on Clarence M. Johns for \$575.50. If the bank charges 2.1% for collection, what are the proceeds?

16. What will a draft for \$2200 cost at 2.2%?

Commercial Draft. We have seen that a draft may be made by one bank on another; it may be made also by one individual on another, or on a business firm, or on a bank.

A **commercial draft** is a written order by which one person directs a second person to pay a specified sum at a stated time, through a bank.

For example, if the Lewis Engraving Company wishes to collect a debt of $960 from Harrison P. Nash of Portland, Me., it may draw on Mr. Nash by means of a commercial draft.

$960.00 ***New York, Dec. 2, 1919.***

At sight pay to the order of

THE NATIONAL CITY BANK OF NEW YORK

Nine hundred sixty $\frac{00}{100}$ ~~~

Time Draft. A time draft is one that is payable some time after being presented to the payee.

For example, Mr. Nash may do business with the Lewis Engraving Company on 30 days' credit. If the company needed money, it would make out a draft to read: "At 60 days sight pay to the order . . . ". This draft would be sent to Mr. Nash with the bill. If he wished to pay it at maturity, he would write across the face in red ink "Accepted, Dec. 5, 1919. Harrison P. Nash," and return it to the drawer. The draft is then called an **acceptance** and is equivalent to a promissory note, due 60 days after acceptance on Dec. 5. To secure the money, the engraving company would then discount it at a bank. If Mr. Nash does not honor the draft when due, the engraving company must refund the money. As a rule, a business house is likely to honor a draft. Otherwise its credit with the banks and with other firms in its own city and elsewhere might be injured by the appearance of refusing to meet one's obligations.

WRITTEN PROBLEMS

1. Find the proceeds of a draft for $1850 if the bank charges $\frac{1}{10}\%$ for collection.

2. What were the proceeds of a draft for $1900 at 60 days sight, accepted Oct. 2, and discounted Oct. 7, at 6%, with an additional collection charge of 85¢?

3. A. B. Small of Little Falls, S. Dak., draws on R. L. Tiernan of San Francisco for $825. The bank charges $\frac{1}{8}\%$ collection fees. Find the proceeds.

4. A manufacturer collects a debt of $1480 through a bank. If the proceeds are $1476.30, what is the bank's rate for collection?

5. A 30-day sight draft for $1020 is accepted Mar. 5, and discounted Mar. 10 at 6%. What are the proceeds?

6. What are the proceeds of a 60-day draft for $1550.10 discounted at 6% for the full term, the bank charging 75¢ in addition for collection?

7. Find the proceeds of a 60-day draft for $2600 accepted Apr. 5, and discounted Apr. 15 at 6%.

8. The King Co. draws on Elliot & Co. for $1050. If the bank charges .1% for collection, what are the proceeds?

The Exchange Market. The cost of bills of exchange, or drafts, varies from time to time, depending on the rate of exchange quoted. As a rule, a bank draft, like a money order, costs more than its face value. Drafts when indorsed are bought and sold by banks and exchange brokers in the open market, and for this reason when the demand exceeds the supply, the rate of exchange rises and exchange is **at a premium,** or **above par,** that is, above the face value of the draft. When the supply exceeds the demand, the price of exchange falls and exchange is said to be **at a discount,** or **below par,** that is, below the face value of the draft. If there is " no exchange," exchange is said to be **at par.**

If in New York there is a large demand for drafts on Chicago without an equivalent demand in Chicago for drafts on New York, the supply of the funds of New York banks on deposit in Chicago banks will become exhausted. To remedy this condition, the price of exchange on Chicago rises, or exchange is at a premium, because the New York banks will be at the trouble and expense of shipping money to Chicago. In Chicago, exchange on New York falls, and exchange will be at a discount.

The premium or discount is generally a certain per cent of the face of the draft, or at a certain rate per $1000.

Exchange on New York may be quoted as follows: Chicago, 10¢ premium; Boston, exchange at par; St. Louis, exchange 70¢ premium; New Orleans, 10¢ discount.

WRITTEN PROBLEMS

Find the cost of a draft for:

1. \$1200 at par
2. \$800 at $\frac{1}{4}\%$ premium
3. \$910 at .1% discount
4. \$1370 at $\frac{1}{8}\%$ premium
5. \$1800 at $\frac{1}{2}\%$ discount
6. \$890 at $1\frac{1}{4}\%$ discount
7. \$2420 at $\frac{1}{20}\%$ premium
8. \$8200 at .2% discount
9. \$11,500 at .1% premium
10. \$22,000 at $\frac{1}{4}\%$ discount

11. A commission agent secures \$1761.40 as proceeds of a sale. He is instructed to send the money less the cost of exchange to his principal in Chicago. Find the face of the draft if exchange is at $\frac{1}{8}\%$ premium.

12. An agent sold 85 music cases at \$11.50. After deducting 5% commission and \$23.40 for freight, he sent the proceeds by draft at .4% premium. How much did he pay for the draft?

13. A commission firm in New York received 396 boxes of grapefruit from a dealer in Florida, paying \$85 freight charges. The New York firm sold 225 boxes of the fruit at \$4.50 each and the remaining boxes at \$3.25 each. After deducting freight charges, 2% commission, $2\frac{1}{2}¢$ per box for storage, and $\frac{1}{8}\%$ on \$1000 insurance, they sent the proceeds by draft. New York exchange being at par, what was the face of the draft?

14. A man owes a Chicago firm a bill of \$1411.20, less 12% discount. How much must he pay for a draft at .2% premium?

15. A sight draft on St. Paul for \$1771 is purchased at $\frac{5}{8}\%$ premium. Find the cost.

16. A draft for \$2840 was bought for \$2836.45. Figure the rate of exchange.

17. A draft for \$5400 was bought for \$5389.20. Was the exchange at a premium or a discount? Calculate the rate.

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Read:		*State approximate equivalents:*		
1.	XLVII	CCXIX	£210	£25	9d.
2.	XLIV	MD	800 R.	800 M.	15s.
3.	CLX	MCIX	125 M.	400 fr.	£95
4.	LXIV	MDCIV	120 R.	1000 R.	11s.
5.	CXIV	CXIX	250 fr.	2000 fr.	88 M.
	State the discounts:				*Add:*
6.	\$1200, $\frac{1}{3}$%	\$450, 20%	\$250, 7%	\$800, $\frac{1}{2}$%	$\frac{3}{4}+\frac{7}{8}$
7.	\$2000, $\frac{1}{4}$%	\$857, 10%	\$430, 9%	\$640, 3%	$\frac{2}{5}+\frac{9}{10}$
8.	\$1600, $\frac{1}{8}$%	\$960, $12\frac{1}{2}$%	\$920, 8%	\$540, 2%	$\frac{6}{26}+\frac{6}{13}$
9.	\$1200, $83\frac{1}{3}$%	\$320, $62\frac{1}{2}$%	\$440, 25%	\$710, 5%	$\frac{5}{6}+\frac{5}{12}$
10.	\$3000, $33\frac{1}{3}$%	\$400, $87\frac{1}{2}$%	\$600, 75%	\$830, 6%	$\frac{7}{5}+\frac{4}{15}$
	Tell amounts earned:			*Solve:*	
11.	3 da. @ \$4.50	3 mo. @ \$135	9 hr. @ .72	7.12×8	$\frac{2}{3}\div\frac{5}{6}$
12.	4 da. @ \$1.75	3 mo. @ \$156	$8\frac{1}{2}$ hr. @ .60	9.34×7	$\frac{3}{4}\div\frac{1}{4}$
13.	6 da. @ \$2.50	2 mo. @ \$68.50	$7\frac{3}{4}$ hr. @ .44	11.17×5	$\frac{7}{8}\div\frac{2}{3}$
14.	5 da. @ \$3.75	4 mo. @ \$88.20	$6\frac{1}{2}$ hr. @ .80	18.08×8	$\frac{5}{6}\div\frac{6}{5}$
15.	3 da. @ \$2.25	2 mo. @ \$96.10	$5\frac{1}{4}$ hr. @ .44	27.10×7	$\frac{9}{10}\div\frac{5}{9}$
			Tell the answers:		
16.	4 da. @ \$3.25	13 hr. @ \$.65	$17.12-5.12$	$3\frac{4}{5}+\frac{1}{2}$	$\frac{2}{3}\times\frac{4}{5}$
17.	5 da. @ \$4.25	22 hr. @ \$.55	$24.36-4.40$	$1\frac{1}{2}+\frac{3}{8}$	$1\frac{1}{2}\times\frac{3}{4}$
18.	6 da. @ \$5.25	$10\frac{1}{2}$hr. @ \$.70	$35.93-8.90$	$5\frac{1}{4}+\frac{5}{12}$	$\frac{5}{8}\times\frac{2}{3}$
19.	$\frac{1}{2}$ da. @ \$2.25	17 hr. @ \$.50	$48.61-7.70$	$1\frac{5}{16}+\frac{3}{4}$	$1\frac{5}{8}\times\frac{1}{2}$
20.	4 da. @ \$1.75	$8\frac{3}{4}$ hr. @ \$.40	$54.03-3.20$	$2\frac{2}{3}+\frac{5}{6}$	$\frac{3}{16}\times\frac{2}{5}$
	State results:				
21.	$4.32+.345$	$7.84-3.51$	$18.41+.71$	$2\frac{3}{4}+\frac{3}{8}$	$4\frac{7}{8}-\frac{1}{4}$
22.	$8.75+2.24$	$6.59-2.47$	$22.63+.43$	$1\frac{5}{7}+\frac{9}{7}$	$2\frac{2}{5}-\frac{3}{10}$
23.	$9.12+3.87$	$3.27-2.17$	$39.47+.53$	$5\frac{1}{2}+\frac{7}{8}$	$1\frac{3}{4}-\frac{1}{12}$
24.	$10.43+3.12$	$4.92-3.81$	$43.65+.41$	$3\frac{5}{8}+\frac{1}{5}$	$3\frac{9}{10}-\frac{1}{3}$
25.	$16.17+4.17$	$5.11-1.09$	$50.84+.21$	$3\frac{2}{3}+\frac{1}{6}$	$1\frac{1}{7}-\frac{5}{7}$
26.	$21.35+5.38$	$7.31-5.30$	$51.73+.33$	$2\frac{1}{3}+\frac{1}{9}$	$2\frac{3}{16}-\frac{1}{8}$
27.	$32.47+6.42$	$6.24-2.90$	$64.98+.64$	$4\frac{9}{11}+\frac{2}{11}$	$3\frac{1}{2}-\frac{7}{12}$

GENERAL WRITTEN PROBLEMS

1. Find the bank discount on a note for $1800, dated Jan. 1, and payable in 3 months without interest, if discounted Feb. 20 at 5%.

2. A dealer buys through an agent 640 yd. carpet at 75¢ a yd. and pays ¾% commission; the freight bill is $2.80. What is the lowest price per yard at which the dealer can sell the carpet without loss?

3. A printer buys from the Cottrell Press Company 3 large presses at $2350 each. He pays one half of the amount in cash and on Feb. 20 gives two 90-day notes, each for one half of the remainder. On Mar. 2 the press company discounts the notes at 6%. Find the proceeds of the two notes.

4. Charles Jones bought of the George H. Johnson Company an automobile for $3800; he paid $2500 in cash and for the balance gave a 3-mo. note with interest at 5%. Write the note dating it today.

5. My agent buys for me 8000 bushels of wheat at 80 cents. 10 days later he sells 4500 bushels at 83 cents. After another 10 days he sells the remainder at 85 cents. Storage charges, 2 cents a bushel. Commission, 1 cent a bushel for buying and for selling. Interest for use of money furnished by agent, 6%. How much did I gain or lose?

6. An agent sold 44 wagons @ $135 each and gave his principal $5197.50 as the proceeds of the sale. Find the rate of the agent's commission.

7. How much interest at 6% is due June 18, 1918, on a note for $250 given June 15, 1916?

8. A broker borrows $7500 in Boston at 4½% and purchases a 7% western mortgage. How much will he gain in 5 years?

9. Olive oil sells at 65¢ a quart tin. If there are 24 tins to a case, what is the duty at 40% ad valorem?

10. Find the cost of fencing a field 58 rd. 12½ ft. long and 39 rd. wide, if the fencing costs $3.25 per rd.

11. A merchant bought 550 barrels of potatoes at $4.25 per barrel, paying cash. He sells the potatoes at $5.00 per barrel, taking in payment a 90-day note bearing interest at 6%. If he discounts the note immediately at a bank at 7%, what does he gain by the transaction?

12. Make a receipted bill of the following items: 26 lb. sugar @ 10¢; 23 lb. lard @ 12½¢; 5 bu. potatoes @ 98¢; 3 gal. 2 qt. molasses @ 65¢ a gal.; 4 lb. rice at 12¢; 8 lb. coffee @ 38¢; 3 heads cabbage @ 14¢; 2 bu. 3 pk. apples at 90¢ a bu.

13. A merchant has to meet a bill for goods of $1840 less 5%. His balance is $2035.76 in one bank and $862 in another. He decides to draw three quarters of the amount from the first bank and the one quarter from the second. What deposit balance will remain in each bank?

14. A storekeeper had a bank balance of $1114.72. He deposited $404.23, $193.72, $256.84, $808.16, $112.43, and $487.36. He drew checks for $175.75, $260, $390, $44.16, $3.39, $51.62, and $630.50. Cast up his present balance.

15. T. Gold of New Orleans draws on Henry L. Klanett of New York for $4400. Write out the draft, supplying the necessary details. If the New Orleans bank charge ⅛% for collection, what are the proceeds?

16. A storekeeper marks shovels at $6 a pair, but selling them at a discount of 10% for cash, gains 20%. State the cost of the shovels.

17. What are the net proceeds of a draft for $1800 at 60 days sight, accepted Dec. 20 and discounted Dec. 30 at 4%, with a charge of 75¢ for collection?

IV. INSURANCE

Disastrous fires, sudden deaths, serious accidents come without warning and often cause heavy money losses, besides much suffering to the injured persons and others dependent on them. Business men and heads of families may, under certain conditions, protect themselves and those dependent on them from the money cost of such losses as these by **insuring** their stocks, buildings, and their lives in insurance companies. These companies collect a small fee every year from thousands of business concerns and individuals who insure themselves, and thus they accumulate great surpluses of money. From these surpluses they are able to pay fairly large sums to those who meet with sudden losses, since fires and deaths will occur every year to only a very small percentage of all those paying in money.

Insurance is protection against loss or damage. It may be *fire* insurance, *life* insurance, *accident* insurance, *marine* insurance, or *health* insurance. There are also special forms of insurance like *burglar* insurance, *automobile* insurance, *plate glass* insurance, and employers' *liability* insurance.

Terms in Insurance. When a man joins an insurance company, a written contract to pay a certain sum in case of loss is signed by the company. This agreement is the **policy.** The sum named in the policy is the **face of the policy.**

The annual fee charged for the insurance is the **premium.** It is usually stated as a certain rate for each $100 of the face of the policy for the time covered by the insurance. If the rate of insurance is 95¢, it means that for each $100 of the amount insured, there is an annual premium of 95¢.

On $7000, this premium would be $70 \times \$.95$, or **$66.50.**

ORAL EXERCISE

State the premiums on the following policies at the given rates:

1. \$900, 70¢
2. \$1550, \$1
3. \$1100, 90¢
4. \$760, \$.50
5. \$1000, \$.75
6. \$7000, \$1.20
7. \$9500, \$2
8. \$18,000, \$ .80
9. \$11,000, \$1.50
10. A man paid as premium \$20 on a policy, the rate being 50¢. What was the face of the policy?
11. The annual premium on an insured building was \$80; the rate was \$2. For what sum was the building insured?
12. If the face of a policy is \$9000 and the premium \$22.50, what rate is paid?

WRITTEN EXERCISE

1. A dealer insured, against fire, his stock of furs for \$14,500, at \$1.20 per \$100. Find the annual premium.
2. At \$2.40, what is the annual premium on a policy for \$8720?
3. A house owner paid a yearly premium of \$21.42 to insure his furniture for $\frac{3}{5}$ of its value; the rate was 85¢. How much was the furniture worth?
4. A house is insured for \$3500; the rate is 65¢. What is the amount paid in advance for three years' insurance on the house?
5. The premium on a launch worth \$4200 is \$20.16. What rate is paid?

Find the premium on each policy at the given rate:

6. \$8200, 45¢
7. \$3800, 38¢
8. \$7500, 75¢
9. \$9700, \$1.40
10. \$8765, \$1.60
11. \$10,600, 24¢
12. \$28,000, 55¢
13. \$34,000, 44¢
14. \$17,500, \$1.68
15. \$45,000, \$1.75

16. A collector insures a picture gallery for $9600, paying a premium of $36. What rate did he pay?

17. A man owned a house worth $12,000. He insured it for 3 yr. for 75% of its value, the rate being $1.50 per thousand per year. How much premium did he pay?

18. An agent has 3 houses worth $15,000 each. Two of the houses are insured for 75% of their value for 3 yr. at $1.20. The third house is insured for 80% of its value for 3 yr. at $1. How much did these policies cost the agent?

19. An owner insures a dwelling for $18,000 at 90¢. How much does the policy cost per annum? If $2500 is added to the insurance now carried, how much does this add to the yearly premium?

20. A man insured a garage for $5500 at $2.50. The garage was destroyed by fire. If it cost $3850 and the owner had to pay for damage done to two cars $375 and $1420, respectively, how much was his total loss?

21. A mechanic paid $25 a year for 5 years for an accident policy which awarded these benefits: $20 a week for total loss of time through accident, and $10 a week for partial loss of time. He was totally disabled 8 weeks and partially disabled 7 weeks. How much did he receive in benefits?

22. A stable owner insured his property for $\frac{3}{4}$ of its value at $1.50, the premium being $117. Find the face of the policy and the value of the property.

23. A house valued at $18,000 and contents valued at $9500 are insured for $\frac{2}{3}$ of their value. If the rate was $1.35 on both, what yearly premium was paid?

Life Insurance. This form of insurance is an indemnity against loss by death. Most men and women who have others depending upon them for support have their own lives insured so that there will be some provision for their

dependents. If a man insures his life for $7000 and pays his annual premiums, it means that upon his death his family or those designated by him in the policy will receive $7000 from the insurance company.

There are several different kinds of policies that may be applied for:

(1) **The Ordinary Life Policy.** In this kind of policy the holder pays a certain premium, annually or semi-annually, until his death, when the face of the policy is paid to the person named as his beneficiary.

(2) **The Limited Payment Life Policy.** In these policies the premiums are paid for a limited number of years, at the end of which time the policies are said to be paid up. The face of the policy is not paid, however, until the death of the insured person. A 25-payment life policy would be fully paid up at the end of 25 years. Other limited policies may be written to insure one's life for any period, like three months or three years.

(3) **Endowment Policies.** Premiums are paid on these policies for a specified number of years, like ten or twenty, at the end of which time the face of the policy is paid to the insured person together with the interest on it. If the person dies before the number of years specified has expired, the face of the policy is paid to his heirs without interest. The rates are higher in this form and in the limited life policy than in the ordinary life policy.

Premiums in life insurance are stated as so much on $1000. They depend on the expectation of life, or the average number of years a healthy person of a given age has yet to life, and the kind of policy applied for.

Policies are also written to insure against loss by accident or ill health.

ORAL EXERCISE

	POLICY	RATE PER $1000	PREMIUM		POLICY	RATE PER $1000	PREMIUM
1.	$6500	$30	$?	5.	$5000	$22.50	$?
2.	$8000	$22	$?	6.	$2000	$14.75	$?
3.	$7000	$?	$147	7.	$42000	$?	$105
4.	$?	$24	$72	8.	$?	$31	$3100

WRITTEN EXERCISE

1. A man takes out a $2500 policy in one company at $23.60 and a $4000 in another company at $24.05. How much does he pay in annual premiums?

2. A man 40 years of age has his life insured for $3500. He must pay $30.55 annually. At the age of 62 years, how much has his insurance cost him?

3. How much will be paid in 25 payments on a $5500 policy at $24.35 per $1000?

ANNUAL PREMIUM RATES FOR INSURANCE OF $1000

AGE	ORDINARY LIFE	10-PAYMENT LIFE	15-PAYMENT LIFE	20-PAYMENT LIFE	20-YEAR ENDOWMENT
25	$19.63	$44.97	$33.68	$28.18	$47.28
30	$22.35	$49.28	$36.98	$31.00	$48.02
35	$25.88	$54.49	$41.00	$34.50	$49.13

Using the rates in the table above, find the annual premium on each policy:

4. Age 25; 15-payment life for $2500.

5. Age 35; 20-year endowment for $4000.

6. Age 30; ordinary life for $7000.

7. Age 35; 20-payment life for $3500.

8. At the age of 35, a man took out a 20-year endowment policy for $2500. How much less would it have cost him in premiums if he had taken it at the age of 25?

9. A policy was issued to a man for \$5000 at \$36.80 per \$1000. How much more than the face of this policy has been paid, if 28 annual premiums have been met?

10. A man takes out a \$5000 policy at \$25.70 per \$1000. He dies just after seven annual premiums have been paid. How much do his beneficiaries receive? How much do they receive in excess of the premiums paid?

11. A man took out a 30-year endowment policy for \$4000 at \$31.57 and lived the full term. Find the total premium paid. How much less would he have paid if the company had credited his policy with \$81.50 per thousand in dividends during the term?

12. A woman secured insurance for \$2500 at \$22.25 per \$1000. If she died after paying 8 premiums, how much more did her heirs receive than the total premium?

13. At 28 years of age, a woman takes out a 25-year endowment policy for \$4000 at \$37.10. What is the annual premium? What are the total premiums to the end of the 25 years?

14. A man took out an accident policy for \$2500. If he paid an annual premium of \$20.50, what rate was he paying per \$1000?

15. A young man took out a 20-payment life policy for \$4000 at \$30.90. He died just before his twentieth payment became due. The company credited his policy with \$77.25 per thousand in dividends during this period, and they were used to reduce the annual premium. How much more did his beneficiaries receive than was paid in premiums?

Workmen's Compensation Law. Most states have now enacted laws requiring employers to make payments to workmen injured at their work, or in case of their accidental death to make provision for the dependents.

The laws cover industries like railroading, mining, printing, shipbuilding, electrical work, work in foundries, factories, laundries, etc. Farm laborers and domestic servants are not included.

In case of death, the employer pays $100 for funeral expenses, 30% of the man's wage to his widow, and 10% additional for each child under 18 years of age. Dependent orphans under 18 receive 15% each, and dependent parents, brothers, or sisters, 15% each. The payments to a widow cease at death or remarriage; payments to children cease at 18. If one's wages exceed $100 monthly, the excess over $100 is not considered.

In case of accident, the employer must pay the cost of medical treatment for 60 days. For total disability, $66\frac{2}{3}\%$ of the wage is paid; for partial disability, less. These payments may not be less than $5 nor more than $15 weekly.

Employers must deposit securities as proof of ability to make these payments or must insure their employees in a company which agrees to pay the compensation.

WRITTEN PROBLEMS

1. A workman's wages are $22 a week. In case of his death how much will each of his two children receive per week? How much will his widow receive per week? How much per week will be paid by the employer to the family?

2. In an accident, a mechanic earning $21.50 per week, was injured and laid up for 71 weeks. What compensation did he receive during this period?

3. A corporation insured its employees, paying a premium of $1.26 per $100 on a total pay roll of $98,700. What premium was paid for the insurance?

V. TAXES

Government Expenses and Revenues. The expenses of the national government before the world war amounted to over $900,000,000 yearly. This great sum, administered by more than 500,000 civil service employees, was spent to maintain the army and navy, to run post offices, to pay pensions to soldiers and employees, to support the Indians, to improve rivers, harbors, and canals, and to pay salaries, and interest charges on the national debt, etc.

In 1914–1915 the revenue of the United States was $1,008,000,000 and the expenditures amounted to $1,065,000,000. This table gives some of the larger items:

REVENUE		EXPENDITURES	
Customs Revenue	$225,000,000	Army	$157,000,000
Internal Revenue	$395,000,000	Navy	$165,000,000
Income Tax	$125,000,000	Pensions	$160,000,000
Miscellaneous	$ 55,000,000	Interest on the public debt	$ 25,000,000
		Agriculture	$ 20,000,000
		Indians	$ 18,000,000
		Salaries, etc.	$225,000,000

WRITTEN PROBLEMS

1. Cast up the total amount of the government expenditures as given in the table. State the average amount expended daily.

2. Of the total revenue as shown in the table, what per cent was derived from duties?

3. Of the total expenditures as shown in the table, what per cent was spent to support the army?

4. Of each dollar spent by the national government how many cents were spent for salaries of officials? How many cents for pensions? How many cents for the support of the Indians?

5. Recently the internal revenue receipts in New York State were $105,000,000. In the same period Delaware's receipts were $3,150,000. What per cent of the New York receipts were those of Delaware?

6. If the total internal revenue receipts were 512 million and those from Pennsylvania were 64 million, tell what per cent of the total that state's receipts were.

Duties. The heavy expenses of the national government are met by the income derived from customs duties, internal revenue taxes, and the federal income tax, etc. We have learned that import or customs duty is a tax set by Congress upon imported goods. When reckoned as a certain per cent of the value of the goods, the import duty is called **ad valorem duty;** when the duty is a certain charge based on the number of articles imported or on their weight, it is called **specific duty.**

WRITTEN PROBLEMS

1. An art dealer paid $557.50 duty on a painting, the rate being 15% ad valorem. State the value placed on the picture.

2. If the duty for woolen clothing is 35%, how much must one pay when importing a suit of clothes which cost $33 in Edinburgh?

3. A candy manufacturer paid $14,310 for a consignment of unsweetened cocoa, including customs charges at 8% ad valorem. Find the rate on cocoa.

4. Figure the duty on 28 doz. electric lamps invoiced at $105.50 a dozen, if the duty is 25% ad valorem.

Find the duty on the following imports at the rate given:

5. \$750, 30%	8. \$1920, 60%	11. \$4940, 45%
6. \$1225, 35%	9. \$2150, 35%	12. \$7500, 15%
7. \$1470, 15%	10. \$3350, 18%	13. \$8360, 25%

14. Some grades of perfumery are taxed 40¢ per lb. and 60% ad valorem. Find the duty on a shipment worth \$3480 weighing 1450 lb.

15. An agent paid 45% duty on a French automobile. The machine cost him, including the duty, \$4930. State the manufacturer's price of the machine.

16. The duty on leather gloves is \$3.25 per doz. pairs. What is the total cost of 36 doz. pairs of gloves which cost \$1.80 a pair abroad?

17. In one year \$766,990.50 was paid to the government as duty on watch and clock movements imported. If the rate is 30%, find the value of the material imported.

18. What was the total duty on 15 doz. blankets @ \$52 a doz., and 540 yd. carpet @ \$1.35, if the duty on the blankets was 30% and on the carpet 50% ad valorem?

19. A dealer imported 60 doz. dolls valued at \$16.40 a doz. If the shipping charges were \$31.50 and the duty 35% ad valorem, find how much each doll cost.

20. A publisher, importing engravings and photographs, paid \$437, duty included. If the rate on these articles is 15%, how much duty did he pay?

21. On a shipment of thread valued at \$3850, an importer paid \$708 in duties. Find the rate on this import.

The Internal Revenue includes the tax levied by the government on the incomes of individuals and corporations and the tax on articles manufactured in this country, such as alcoholic liquors, tobacco, playing cards, and adulterated butter and oleomargarine.

WRITTEN PROBLEMS

1. In 1914 the income tax revenue was \$71,381,274; in 1916 it was \$124,937,252. What was the increase?

2. Of the miscellaneous receipts in 1917 amounting to \$1,678,025, 42% was derived from the tax on oleomargarine. What did the tax on this product amount to?

3. How many pounds of adulterated butter were manufactured in 1917, if the tax received on this commodity at 10¢ a lb. amounted to \$19,222?

State and City Expenses. We have seen that a city is required to spend large sums of money to maintain health, fire, police, and water departments, to maintain schools, streets, parks, and institutions for the sick, the criminal, and the insane. The state must provide the funds for the maintenance of a host of officials, and it must build and maintain roads, schools, prisons, and other institutions.

WRITTEN PROBLEMS

1. The per capita fire loss in a city for one year was \$1.03. There were 942,200 inhabitants. What was the total loss?

2. A city was able to run its administrative departments for \$2,732,000 less one year than the preceding. If the population was 2,185,000, find the saving per capita.

3. The cost of running a city health department for one year was \$767,532. The following year the cost was reduced to \$639,610. By what per cent was the cost reduced?

4. In the correctional institutions of a city there are 6410 inmates. If the yearly cost per capita is \$232.85, what is the total expense to the city?

5. For the partial care of 23,420 children in private charitable institutions, a city government has contributed

annually $664,191.20. Average the annual cost per child.

6. A city whose population is 1,928,400, was using 81 gal. of water a day per capita. Find the total number of gal. used daily. The following year the amount was reduced to 76 gal. daily per capita. Tell the total daily saving.

7. A municipal police department employs 93 captains at $2750 a year; 548 lieutenants at $2250 a year; and 652 sergeants at $1750 a year. Figure the total salaries paid to this part of the police force.

8. An apportionment of $10,000 was granted a State Purchasing Department. If the Agent receives $416.66⅔ a month, what per cent of the total apportionment is his yearly salary?

State and City Taxes. Property is classified for taxation purposes as **real estate,** including land and buildings, and **personal property,** including clothing, furniture, money, cattle, and other movable property. Tax officials first estimate the sum needed to meet the governmental expenses for one year, and other officials, called **assessors,** inspect the real estate and place a value on it. They divide the sum needed, by the total assessed value of the property. The result indicates the **tax rate,** usually expressed as either a number of mills on each dollar, say, 3.7 mills; or a certain sum on each hundred dollars, say, $3.70 per $100; or a certain per cent of the assessed valuation, say, 3.7%.

The state may derive income from other sources; such as the issuing of licenses and permits; collecting a poll tax on male citizens over 21 who do not pay taxes on real estate; or levying a state tax of so many mills on each dollar's worth of personal property.

WRITTEN PROBLEMS

1. At a tax rate of \$1.24 on \$100, what is the tax on property assessed at \$8640?

2. An estate assessed at \$14,600 is taxed at $5\frac{1}{2}$ mills. What is the amount of the tax?

Find the tax on the following property:

3. \$3400 at $1\frac{1}{4}$ mills
4. \$5700 at $5\frac{1}{2}$ mills
5. \$10500 at \$17.40 per \$1000
6. \$24600 at $2\frac{1}{2}\%$
7. \$35700 at $1\frac{3}{4}\%$
8. \$13200 at \$1.71 per \$100

9. How much tax must a man pay who owns a house assessed at \$3945, a store assessed at \$8750, and a factory assessed at \$29,500, if the tax rate is \$2.35 per thousand?

10. If the tax rate is 3.1%, what will be the amount of the tax on property assessed at \$25,200?

11. A town levied a tax of \$438.75 on a man whose real estate was assessed at \$38,250 and personal property at \$10,500. What tax rate did he pay?

12. The assessed valuation of a school district is \$564,000; the amount to be raised by tax is \$5000. What would be the amount of the school tax on property valued at \$1200?

Municipal Taxation: New York. Greater New York taxes real estate and personal property. The taxable area is 315 square miles, and it houses 5,700,000 inhabitants. The assessed valuation of the real estate is \$8,390,000,000, distributed in the boroughs as follows:

BOROUGH	ASSESSED VALUE OF REAL ESTATE	TAX RATE
Manhattan:	\$5,400,000,000	\$2.04
The Bronx:	\$ 664,300,000	\$2.09
Brooklyn:	\$1,720,000,000	\$2.08
Queens:	\$ 495,000,000	\$2.06
Richmond:	\$ 84,000,000	\$2.13

The money raised by taxation is expended among the city departments as follows:

Interest Charges and Payments on City Debt	$53,000,000
Educational Work	41,000,000
Police and Fire Departments	33,000,000
Health and Sanitation	18,000,000
Expenses of City Courts and Prisons	11,000,000
Charity	10,000,000
State Taxes, Rents, and Pensions	17,000,000
Care of Streets and Bridges	7,000,000
Parks and Museums	4,000,000
Docks and Ferries	3,000,000
Salaries of Officials	4,000,000
Public Buildings and Offices	2,000,000
Total	$203,000,000

WRITTEN EXERCISE

1. Compute from the table on the preceding page, the amount of taxes in Manhattan and the Bronx.

2. A man owns a house in Queens assessed at $11,400 and a store in the Bronx assessed at $8300. Find the amount of his taxes.

3. The tax rate in Manhattan rose from $1.40 to $2.03 in ten years. By what per cent did it increase?

4. The total property in New York City owned by the United States government and therefore exempted from taxation is $67,130,000. What would the taxes on this sum amount to at the average rate?

5. A street railway company pays a tax of $3737.87 on property assessed at $181,450. Figure the rate of tax.

6. Using the table, find by how much the taxes of Brooklyn exceed those of Queens and Richmond together.

7. If a man owns real estate in Manhattan assessed at $42,750, how much is he taxed on this property?

A STOCK CERTIFICATE

VI. THE BUSINESS OF CORPORATIONS

STOCKS AND BONDS

What a Corporation is. Many great business enterprises today are so vast that they require the investment of enormous sums of money. One individual or even a group of partners may be unable to furnish all the money required. For example, the organization of a railroad, a telephone company, a great mining system, a large bread, meat, or canning company involves the expenditure sometimes of millions of dollars.

In order to carry on an enterprise of this kind a group of persons come together and each contributes a portion of the **capital** required. The group may, under certain conditions, be authorized by law to transact business as an individual and, when legally organized, becomes a **corporation** or **stock company.** Its powers and limitations are written down in a **charter** granted by the state. A group of men might decide to erect biscuit factories in several cities, an enterprise requiring, say, $1,000,000. They might invest $600,000 of their own money and invite other people to invest the remainder of the money required, $400,000. To this end, the procedure is to divide the capital of the company, $1,000,000, into shares of $100 each; and each investor would apply for as many shares as he wished. If one had $5000 to invest, he would buy 50 shares, become a shareholder, and receive 50 **certificates of stock.**

Ordinarily it is some one or more of the founders of the business who manage the factories and sales offices; and if the products were well advertised and sold, the business would begin in due course to make profits. Every year these

profits would be divided up among the stockholders, as **dividends,** according to the number of shares each stockholder has. Others might then wish to buy some of the stock; but the holders might not now sell for \$100 a share; if the stock sells above the stated \$100 value, it is said to be **above par.**

WRITTEN EXERCISE

1. The organizers of a coal company issued 4500 shares, each share being worth \$50. What was the amount of capital stock?

2. The stock rose above par to \$63. Tell the value of 360 shares at this price.

3. I bought 130 shares of a 5% stock at \$115 per share, paying $\frac{1}{8}$% brokerage. At the end of 2 years, I sold it for \$98 per share, paying $\frac{1}{8}$% brokerage. What was my net loss?

4. A company which has a capital of \$550,000 divides \$50,000 in dividends. If Mr. Fasset owns 48 shares, how much will he receive?

5. A corporation issued 25,000 shares of stock, making its capital \$2,500,000. How much was each share worth at par?

6. A certain stock fell below par to \$73. Find the value of 75 shares at this price, the par being \$100.

7. On a capital stock of \$750,000 a corporation declared a net gain of $4\frac{1}{2}$%. Find the amount of profit.

8. On a capital stock of \$220,000 a firm makes a profit of \$17,600. What per cent of profit is this?

9. By issuing stock at \$100, a company raised a capital of \$800,000. How many shares were issued?

Kinds of Stock and Dividends. Many corporations adopt $100 as the par value of the shares. Others whose business, say, is that of mines, oil wells, or automobiles, may price their shares at $50, or $10, or even $1. The actual value of the stock depends upon whether or not the business is profitable. In the examples in this book the par value of each share is assumed to be $100 if not otherwise stated.

The profit, or *dividend*, declared at the end of stated periods, annually, semiannually, or quarterly, is usually a certain percentage of the capital stock. If the biscuit company declares a quarterly dividend of 3%, it pays at the end of a 3-mo. period $3 on each share of stock issued at $100.

In many companies the stock is of two kinds: **preferred stock** and **common stock**. Preferred stock pays a certain fixed rate of dividend; common stock pays such percentage of the profits as the corporation may declare after having provided for the preferred stock dividends. If the business is very successful, the common stock dividends may be larger than those paid on preferred stock.

All the business of the corporation, including the declaration of the dividends, is done by a **board of directors** elected by the stockholders from their own number. In this election each holder of a share of stock is entitled to one vote. The directors elect the *officers*, a president, a vice-president, a secretary, a treasurer, etc. If a business has been unsuccessful, the dividend is **passed**, and the officers may call upon the shareholders to contribute an additional sum of money, according to the number of shares held, to supply more capital to make good the losses, or to help the business. The sum thus levied is an **assessment**.

WRITTEN PROBLEMS

1. A company capitalized at $750,000 declares a dividend of 8%. What will a stockholder receive who holds 300 shares?

2. On a capital stock of $2,200,000, there is a net gain of $110,000. What per cent of dividend may be declared?

3. An investor holds 520 shares of railroad stock. How much will he receive if the company declares a $5\frac{1}{2}\%$ dividend?

4. Find the annual income of a man who buys $35,200 worth of stock at 160, if the semiannual dividends are $3\frac{1}{4}\%$.

5. A railway company with a capital of $280,000 pays its stockholders $5600 quarterly. What would be the annual income from 30 shares of this stock?

6. A baking company with a capital of $1,720,000 declares a semiannual dividend of $3\frac{1}{4}\%$. Find the amount of the dividends.

7. A corporation, owing to poor business, loses $48,750. The capital is $650,000. At what per cent must each shareholder be assessed to make up the loss? If I own 25 shares, what must I contribute?

8. The net annual earnings of an automobile company capitalized at $480,000 were $53,850. If the directors retained $8250 for a reserve fund and distributed the remainder in dividends, what would be one's income from 85 shares of the stock?

Brokers and Brokerage. We have learned that the market value of stock is the price at which it can be bought at a particular time. When it fetches its face value, say $100, it is *at par*. If a stock pays a high rate of dividend, more people will wish to buy it and it will sell *above par*. If the dividends are low, the price will drop and the stock will fall *below par*.

A **broker** is a person who buys and sells stocks and bonds for others. He charges a commission, usually $\frac{1}{8}\%$ of the par value of $100 shares, for buying or selling. This commission, $12\frac{1}{2}¢$ per $100, is called **brokerage**. The stock is usually bought or sold at a **stock exchange**.

Stock Quotations. The stock column in a newspaper gives the following quotations for a certain day on the New York Stock Exchange:

American Express	$104\frac{3}{4}$
American Locomotive pf	105
Delaware & Hudson	$112\frac{7}{8}$
Midvale Steel	$65\frac{7}{8}$
Pacific Mail	$27\frac{1}{4}$
Sinclair Oil	$55\frac{1}{2}$
Underwood Typewriter	$97\frac{1}{2}$
United Fruit	$139\frac{1}{4}$
U. S. Rubber	$62\frac{1}{2}$
Utah Copper	$116\frac{3}{8}$

These quotations mean that American Express common stock will cost the buyer $104.75 plus the brokerage; to buy a share of Underwood Typewriter common stock $97.50 must be paid, plus the brokerage. If the par value is $100, the brokerage is $\frac{1}{8}\%$ of $100, or $12\frac{1}{2}¢$ per share. The buyer pays $\$97.50+\$.12\frac{1}{2}$, or $\$97.62\frac{1}{2}$ per share, while the seller, who also pays brokerage, receives $\$97.50-\$.12\frac{1}{2}$, or $\$97.37\frac{1}{2}$ per share.

If an investor bought 50 shares, he would pay $50\times\$97.62\frac{1}{2}$; if he sold 50 shares, he would receive $50\times\$97.37\frac{1}{2}$.

ORAL EXERCISE

From the quotations above, compute the cost of a share of stock, adding the brokerage:

1. Amer. Express
2. United Fruit
3. Utah Copper
4. Delaware & Hudson
5. Underwood Typewriter
6. Amer. Locomotive

How much will be received from the sale of 10 *shares of stock, at the following prices, allowing for the broker's commission?*

7. $130\frac{7}{8}$ 9. $73\frac{5}{8}$ 11. $141\frac{1}{8}$
8. $111\frac{1}{8}$ 10. $69\frac{1}{8}$ 12. $177\frac{5}{8}$

13. An investor bought 100 shares of National Ice at $23\frac{7}{8}$. Find the cost including brokerage.

WRITTEN EXERCISE

Estimate the cost of the following stock, including brokerage:

1. 10 shares at $43\frac{1}{2}$ 5. 110 shares at $32\frac{7}{8}$
2. 35 shares at $22\frac{3}{8}$ 6. 250 shares at $104\frac{7}{8}$
3. 75 shares at $160\frac{1}{8}$ 7. 330 shares at $99\frac{1}{4}$
4. 80 shares at 102 8. 500 shares at $139\frac{1}{2}$

Also the amount received for the following stock, deducting brokerage:

9. 50 shares at $52\frac{1}{2}$ 13. 150 shares at $119\frac{1}{8}$
10. 85 shares at $65\frac{3}{4}$ 14. 270 shares at $109\frac{1}{4}$
11. 110 shares at $101\frac{1}{2}$ 15. 420 shares at $153\frac{1}{2}$
12. 175 shares at $41\frac{7}{8}$ 16. 700 shares at $99\frac{1}{8}$

WRITTEN PROBLEMS

1. A broker sells for me 85 shares of beet sugar stock at $38\frac{3}{4}$. After deducting his brokerage, how much does he send me?

2. How much must be paid for 1200 shares of Central Leather at $98\frac{7}{8}$?

3. Mr. M. sold 75 shares of Kennecott Copper at $47\frac{1}{2}$. How much did he receive for them?

4. Find the cost of 2500 shares of Lackawanna Steel at $98\frac{7}{8}$.

5. An investor sold 120 shares of Mexican Petroleum at $101\frac{3}{4}$. What was his return from the sale?

6. If Mo. Pacific is $24\frac{1}{4}$, how much will 1250 shares cost?

7. 940 shares of Columbia Gas were bought at $41\frac{1}{2}$. Tell the total cost.

8. A speculator bought 100 shares of stock at $91\frac{1}{2}$ and sold it at $95\frac{1}{4}$. How much did he pay in brokerage? How much did he gain on the deal?

If brokerage is charged for both buying and selling, compute the gain or loss in the following stock transactions:

	SHARES	BOUGHT AT	SOLD AT		SHARES	BOUGHT AT	SOLD AT
9.	10	$139\frac{1}{2}$	$145\frac{1}{8}$	14.	120	$221\frac{1}{4}$	$235\frac{1}{2}$
10.	50	45	$51\frac{1}{4}$	15.	150	$48\frac{1}{2}$	$52\frac{3}{4}$
11.	75	$25\frac{1}{8}$	$23\frac{1}{2}$	16.	200	$91\frac{3}{4}$	$87\frac{1}{2}$
12.	80	$93\frac{3}{4}$	$88\frac{1}{2}$	17.	450	$117\frac{1}{8}$	111
13.	95	$112\frac{1}{2}$	$133\frac{1}{3}$	18.	270	$116\frac{2}{3}$	$112\frac{1}{2}$

19. If a man buys 320 shares of White Motors at $46\frac{7}{8}$ and sells at $48\frac{1}{2}$, does he lose on the operation?

20. Find how much a broker should remit to a customer after selling for him 345 shares of Brown Shoe at $71\frac{1}{8}$.

21. An investor paid \$7756.25, including brokerage, for 50 shares of railroad stock. At what price was it selling?

22. For 125 shares of stock, a man paid, including brokerage, \$6562.50. Find how much he paid per share.

23. After paying his broker, an investor received from the sale of Cuban Sugar stock at $93\frac{1}{2}$, \$5602.50. How many shares did he sell?

24. When Tobacco Products is selling at $52\frac{5}{8}$, how many shares can be bought for \$3692.50?

Calculate the number of shares that can be bought for:

25. \$6030 at $75\frac{1}{4}$
26. \$3231 at $44\frac{3}{4}$
27. \$5225 at $208\frac{7}{8}$
28. \$10,650 at $106\frac{3}{8}$
29. \$5100 at $101\frac{7}{8}$
30. \$4762.50 at $31\frac{5}{8}$
31. \$7521.25 at $68\frac{1}{4}$
32. \$18,750 at $149\frac{7}{8}$

UNITED STATES OF AMERICA

Number 00000 Number 00000

1000. 1000.

AMERICAN LOCOMOTIVE COMPANY

STATE OF NEW YORK

FIVE PER CENT GOLD NOTE

SERIES K

For Value Received the American Locomotive Company promises to pay to bearer, or if this note be registered, to the registered holder hereof,

ONE THOUSAND DOLLARS,

in gold coin of the United States of the present standard of weight and fineness, at its office or agency in the City of New York, on the first day of July, in the year 1917 and on presentation and surrender of the annexed coupons as they become due to pay interest thereon at the rate of five per centum per annum in like coin, at said office, in semi-annual payments on the first days of January and July from date hereof until the principal is paid, provided this note is paid without deduction on account of taxes to be assessed upon the company.

This Company covenants that it will not issue any bonds or other evidences of indebtedness secured by any mortgage upon its railroad, or any part thereof, or upon any of its franchises, except upon the condition that this note shall be equally and ratably secured by such mortgage; and that it will not pledge any of the assets of the Company as security for any such bonds or other evidences of indebtedness, unless this note shall be equally and ratably secured thereby and by the pledge of such assets, without any preference, priority or privilege whatsoever; and that it will not create any mortgage upon its railroad, or any part thereof, or upon any of its franchises, or pledge any of the assets of the Company as security for any such bonds or other evidences of indebtedness, unless this note shall be secured thereby equally and ratably with all other bonds or evidences of indebtedness secured by such mortgage or pledge, and that it will not create any such mortgage or pledge which shall not provide that the holder of this note shall be entitled to receive bonds secured thereby in exchange for this note, dollar for dollar of principal, at any time within one year after the creation of such mortgage or pledge, upon the surrender of this note, with all coupons thereto attached, maturing subsequent to the date of such exchange.

This is one of an authorized issue of notes of the aggregate principal of Six Million Dollars ($6,000,000) dated June 1, 1907, and issued in series, of which this note is of Series K, to be numbered from 5001 to 6000 inclusive, and of the date of first Series A, to be numbered from 1 to 1000 inclusive, and of the date of first Series B, to be numbered from 1001 to 2000 inclusive, and of the date of first Series C, to be numbered from 2001 to 3000 inclusive, and of the date of first Series D, to be numbered from 3001 to 4000 inclusive, and of the date of first Series E, to be numbered from 4001 to 5000 inclusive, and of the date of first Series F, to be numbered from 6001 to 7000 inclusive, and of the date of first Series G, to be numbered from 7001 to 8000 inclusive, and of the date of first Series H, to be numbered from 8001 to 9000 inclusive, and of the date of first Series I, to be numbered from 9001 to 10000 inclusive, and of the date of first Series J, to be numbered from 10001 to 11000 inclusive, and of the date of first Series K, to be numbered from 11001 to 12000 inclusive, and of the date of first Series L, to be numbered from 12001 to 13000 inclusive, and of the date of first Series M, to be numbered from 13001 to 14000 inclusive, and of the date of first Series N, to be numbered from 14001 to 15000 inclusive, and of the date of first Series O, to be numbered from 15001 to 16000 inclusive, and of the date of first Series P, to be numbered from 16001 to 17000 inclusive, and of the date of first Series Q, to be numbered from 17001 to 18000 inclusive, and of the date of first Series R, to be numbered from 18001 to 19000 inclusive, and of the date of first Series S, to be numbered from 19001 to 20000 inclusive, and of the date of first Series T, to be numbered from 20001 to 21000 inclusive, and of the date of first Series U, to be numbered from 21001 to 22000 inclusive, and of the date of first Series V, to be numbered from 22001 to 23000 inclusive, and of the date of first Series W, to be numbered from 23001 to 24000 inclusive, and of the date of first Series X, to be numbered from 24001 to 25000 inclusive, and of the date of first Series Y, to be numbered from 25001 to 26000 inclusive, and of the date of first Series Z, to be numbered from 26001 to 27000 inclusive, and of the date of first Series AA, to be numbered from 27001 to 28000 inclusive, and of the date of first Series BB, to be numbered from 28001 to 29000 inclusive, and of the date of first Series CC, to be numbered from 29001 to 30000 inclusive, and of the date of first Series DD, to be numbered from 30001 to 31000 inclusive, and of the date of first Series EE, to be numbered from 31001 to 32000 inclusive, and of the date of first Series FF, to be numbered from 32001 to 33000 inclusive, and of the date of first Series GG, to be numbered from 33001 to 34000 inclusive, and of the date of first Series HH, to be numbered from 34001 to 35000 inclusive, and of the date of first Series II, to be numbered from 35001 to 36000 inclusive, and of the date of first Series JJ, to be numbered from 36001 to 37000 inclusive, and of the date of first Series KK, to be numbered from 37001 to 38000 inclusive, and of the date of first Series LL, to be numbered from 38001 to 39000 inclusive, and of the date of first Series MM, to be numbered from 39001 to 40000 inclusive, and of the date of first Series NN, to be numbered from 40001 to 41000 inclusive, and of the date of first Series OO, to be numbered from 41001 to 42000 inclusive, and of the date of first Series PP, to be numbered from 42001 to 43000 inclusive, and of the date of first Series QQ, to be numbered from 43001 to 44000 inclusive, and of the date of first Series RR, to be numbered from 44001 to 45000 inclusive, and of the date of first Series SS, to be numbered from 45001 to 46000 inclusive, and of the date of first Series TT, to be numbered from 46001 to 47000 inclusive, and of the date of first Series UU, to be numbered from 47001 to 48000 inclusive, and of the date of first Series VV, to be numbered from 48001 to 49000 inclusive, and of the date of first Series WW, to be numbered from 49001 to 50000 inclusive, and of the date of first Series XX, to be numbered from 50001 to 51000 inclusive, and of the date of first Series YY, to be numbered from 51001 to 52000 inclusive, and of the date of first Series ZZ, to be numbered from 52001 to 53000 inclusive, and of the date of first Series AAA, to be numbered from 53001 to 54000 inclusive, and of the date of first Series BBB, to be numbered from 54001 to 55000 inclusive, and of the date of first Series CCC, to be numbered from 55001 to 56000 inclusive, and of the date of first Series DDD, to be numbered from 56001 to 57000 inclusive, and of the date of first Series EEE, to be numbered from 57001 to 58000 inclusive, and of the date of first Series FFF, to be numbered from 58001 to 59000 inclusive, and of the date of first Series GGG, to be numbered from 59001 to 60000 inclusive, and of the date of first Series HHH, to be numbered from 60001 to 61000 inclusive, and of the date of first Series III, to be numbered from 61001 to 62000 inclusive, and of the date of first Series JJJ, to be numbered from 62001 to 63000 inclusive, and of the date of first Series KKK, to be numbered from 63001 to 64000 inclusive, and of the date of first Series LLL, to be numbered from 64001 to 65000 inclusive, and of the date of first Series MMM, to be numbered from 65001 to 66000 inclusive, and of the date of first Series NNN, to be numbered from 66001 to 67000 inclusive, and of the date of first Series OOO, to be numbered from 67001 to 68000 inclusive, and of the date of first Series PPP, to be numbered from 68001 to 69000 inclusive, and of the date of first Series QQQ, to be numbered from 69001 to 70000 inclusive, and of the date of first Series RRR, to be numbered from 70001 to 71000 inclusive, and of the date of first Series SSS, to be numbered from 71001 to 72000 inclusive, and of the date of first Series TTT, to be numbered from 72001 to 73000 inclusive, and of the date of first Series UUU, to be numbered from 73001 to 74000 inclusive, and of the date of first Series VVV, to be numbered from 74001 to 75000 inclusive, and of the date of first Series WWW, to be numbered from 75001 to 76000 inclusive, and of the date of first Series XXX, to be numbered from 76001 to 77000 inclusive, and of the date of first Series YYY, to be numbered from 77001 to 78000 inclusive, and of the date of first Series ZZZ, to be numbered from 78001 to 79000 inclusive, and of the date of first Series AAAA, to be numbered from 79001 to 80000 inclusive, and of the date of first Series BBBB, to be numbered from 80001 to 81000 inclusive, and of the date of first Series CCCC, to be numbered from 81001 to 82000 inclusive, and of the date of first Series DDDD, to be numbered from 82001 to 83000 inclusive, and of the date of first Series EEEE, to be numbered from 83001 to 84000 inclusive, and of the date of first Series FFFF, to be numbered from 84001 to 85000 inclusive, and of the date of first Series GGGG, to be numbered from 85001 to 86000 inclusive, and of the date of first Series HHHH, to be numbered from 86001 to 87000 inclusive, and of the date of first Series IIII, to be numbered from 87001 to 88000 inclusive, and of the date of first Series JJJJ, to be numbered from 88001 to 89000 inclusive, and of the date of first Series KKKK, to be numbered from 89001 to 90000 inclusive, and of the date of first Series LLLL, to be numbered from 90001 to 91000 inclusive, and of the date of first Series MMMM, to be numbered from 91001 to 92000 inclusive, and of the date of first Series NNNN, to be numbered from 92001 to 93000 inclusive, and of the date of first Series OOOO, to be numbered from 93001 to 94000 inclusive, and of the date of first Series PPPP, to be numbered from 94001 to 95000 inclusive, and of the date of first Series QQQQ, to be numbered from 95001 to 96000 inclusive, and of the date of first Series RRRR, to be numbered from 96001 to 97000 inclusive, and of the date of first Series SSSS, to be numbered from 97001 to 98000 inclusive, and of the date of first Series TTTT, to be numbered from 98001 to 99000 inclusive, and of the date of first Series UUUU, to be numbered from 99001 to 100000 inclusive, and of the date of first Series VVVV, to be numbered from 100001 to 101000 inclusive, and of the date of first Series WWWW, to be numbered from 101001 to 102000 inclusive, and of the date of first Series XXXX, to be numbered from 102001 to 103000 inclusive, and of the date of first Series YYYY, to be numbered from 103001 to 104000 inclusive, and of the date of first Series ZZZZ, to be numbered from 104001 to 105000 inclusive, and of the date of first Series AAAAA, to be numbered from 105001 to 106000 inclusive, and of the date of first Series BBBBB, to be numbered from 106001 to 107000 inclusive, and of the date of 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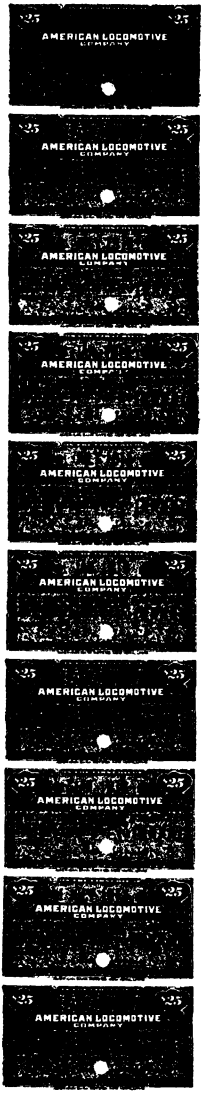


Bonds. If the biscuit company wished to enlarge its business by erecting factories in ten more cities, it could obtain the money required by issuing and selling *bonds*. A **bond** is a written or printed promise, usually printed, to pay a certain sum at a specified time when the bond matures, and to pay a fixed rate of interest on the face value at regular times. Generally the bond bears small detachable slips or **interest coupons,** each a promise to pay the stated interest at the stated period.

Bonds are usually a safer investment than stocks. If the bonds and the interest are not paid when due, the bondholders may compel the sale of the property of the corporation to get back their loans. The interest on the bonds must be paid before the dividends are shared among the stockholders. In this way the profits on shares of stock depend on the earnings of a company, while the earnings of bonds, on their face or par value, are always guaranteed.

Bonds are usually issued for $500 or $1000. The prices of bonds are quoted with reference to $100 of value. A quotation of $112 means that every $100 of par value is worth $112. A $1000 bond would sell at $1120.

Government Bonds. Bonds are issued by the national government and by states, counties, cities, and towns when they wish to borrow money. These are not secured by mortgage. U. S. 3's, 1918–1928, means United States government bonds paying 3% interest due 1928, payment of the bond being optional on any interest date after 1918. War bonds are those issued by a government to provide money for war expenses.

WRITTEN PROBLEMS

1. If Pacific Gas 5's are quoted at $88\frac{5}{8}$, how much would five $1000 bonds cost, including brokerage?

2. What annual income would be realized from $25,000 worth of $3\frac{1}{2}$% bonds?

3. U. S. bonds, paying 3% interest, are selling at $104\frac{1}{4}$. Find the cost of 8 bonds.

4. An investor sold 45 Central Leather 5's at $100\frac{1}{4}$. How much did he receive for the sale?

5. Reckon the loss to an investor who bought N. Y. Central 6's at $106\frac{7}{8}$ and sold them at $101\frac{1}{4}$.

6. How many bonds, City of Tokio 5's at $76\frac{1}{2}$, can be bought for $6743?

7. Mr. M. R. Harrison received $13,005 from the sale of Consolidated Gas bonds at $108\frac{1}{2}$. How many shares did he have in the company?

Rate of Income on Bonds. If a 6% bond is bought at $149\frac{7}{8}$, what is the rate of income on the investment?

Bond incomes, like stock dividends, are always based on the par value of the bond.

The cost of $100 worth of bonds is:

$\$149.87\frac{1}{2} + \$.12\frac{1}{2}$, or $150

The income on $100 worth of bonds is:

6% of $100, or $6

The rate of income is $\$6 \div \$150$, or 4%.

WRITTEN PROBLEMS

1. What per cent will an investor gain if he buys 5% bonds at $74\frac{7}{8}$?

2. I buy a bond paying 5% interest for $79\frac{7}{8}$. Find the rate of income.

3. Figure the per cent of the return on the purchase if I buy 5% bonds at $89\frac{7}{8}$.

4. Which is the better investment: stock at $79\frac{7}{8}$ paying 4% dividends, or stock selling at $119\frac{7}{8}$ paying 6%?

5. Which is the more profitable investment: stock selling at $134\frac{7}{8}$ and paying 7%, or a 5% bond selling at $89\frac{7}{8}$?

6. Find the rate of income on 5% bonds at $103\frac{5}{8}$. On 6% bonds at $87\frac{1}{2}$.

7. 5% bonds are bought at $124\frac{7}{8}$. Find the rate of income.

8. 4% bonds are bought at $61\frac{3}{8}$. Find the rate of income.

9. 3% bonds are bought at 75. Find the rate of income.

Investing Money. We have seen that a bond is really a promissory note the interest and face value of which must be paid at stated times. The income from stocks is uncertain. There are some stocks which because they pay large dividends are highly valued, but these are seldom the stocks which by extensive advertising offer enticing dividends to investors. Investing money in cheap mining stocks is very hazardous; very few of such stocks ever pay dividends. The higher the rate of income offered by an investment, the greater, usually, is the risk. On the other hand, when an investment is very safe, the rate of its income is usually low. Every year thousands of people, without consulting bankers or reliable stock brokers, invest in widely advertised ventures presented by over-sanguine or dishonest persons and thus throw away their savings.

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Find the areas:			*Solve:*	
1	8′ ×14′	9″ ×$\frac{1}{3}$″	$3\frac{1}{2}$″ ×2″	5.4×10	241+75
2.	800′ ×25′	3″ ×27″	11″ ×1′	9.71×10	385+86
3.	95′ ×101′	7′ ×20 yd.	86″ ×11″	2.3×20	371+89
4.	20 yd.×$\frac{1}{2}$ yd.	4 yd.×$\frac{1}{3}$′	36″ ×36′	3.3×30	346+94
5.	24 rd.×7 rd.	$4\frac{1}{2}$″ ×4″	3 yd.×5′	1.2×50	393+98
	Find the volumes:		*State results:*		
6.	24′ × 2′ ×5′	36′ × 4′ ×$\frac{5}{12}$′	$75\frac{3}{4}-5\frac{1}{2}$	.79×100	149−32
7.	8″× 9″×2″	16″× 3″×$\frac{1}{2}$″	$63\frac{7}{8}-3\frac{1}{4}$	.16×100	157−47
8.	3′ × $\frac{2}{3}$′ ×$\frac{3}{4}$′	4′ ×20′ ×$\frac{3}{4}$′	$89\frac{4}{5}-9\frac{2}{5}$	.14×200	163−50
9.	6′ ×12′ ×$\frac{1}{3}$′	18′ × 4′ ×$\frac{2}{3}$′	$51\frac{6}{7}-1\frac{6}{7}$	.15×300	171−63
10.	18″×10″×2″	28″× 3″×$\frac{1}{4}$″	$43\frac{8}{9}-3\frac{2}{9}$	.16×500	181−72
	Find discount on:	*Multiply:*		*Add:*	
11.	$550 at 4%	39×7	1.5×60	$128\frac{2}{3}+5\frac{1}{2}$	169+39
12.	840 at 5%	26×4	.5×400	$216\frac{1}{4}+6\frac{1}{8}$	185+43
13.	2800 at $\frac{1}{7}$%	76×3	.71×40	$304\frac{3}{8}+3\frac{1}{4}$	213+54
14.	320 at $6\frac{1}{4}$%	85×5	1.2×70	$161\frac{4}{5}+8\frac{4}{5}$	225+62
15.	3000 at $1\frac{1}{2}$%	11×11	2.2×800	$159\frac{2}{3}+1\frac{2}{3}$	237+81
	Find values:				
16.	72 @ $.37$\frac{1}{2}$	64 @ 1.12\frac{1}{2}$	96÷6	59÷3	113−29
17.	60 @ .16$\frac{2}{3}$	33 @ .50	76÷4	65÷5	121−32
18.	88 @ .62$\frac{1}{2}$	22 @ 10.50	96÷4	64÷3	135−43
19.	20 @ 7.50	240 @ .87$\frac{1}{2}$	84÷6	110÷5	143−54
20.	14 @ 4.50	1200 @ .25	68÷4	108÷9	156−58
21.	.522×1000	.563×100	$\frac{7}{12}$ of 96	5×46	157+63
22.	.167×1000	.105×300	$\frac{8}{9}$ of 81	7×25	163+72
23.	.042×2000	.14×500	$\frac{4}{11}$ of 88	96÷12	191+85
24.	.012×3000	.11×700	$\frac{1}{2}$ of 78	63÷21	214+91
25.	.002×5000	.12×900	$\frac{3}{15}$ of 75	76÷38	338+48

GENERAL WRITTEN PROBLEMS

1. An agent charged \$292.50 for selling a lot at \$9750. What rate of commission did he charge?

2. In a city where the total tax was fifty million dollars, \$2,400,000 was spent for charitable institutions and \$9,300,000 for education. What per cent of the total tax was spent for each of these purposes?

3. The three sides of a triangular field are respectively 60 rd., 80 rd., and 100 rd. Compute the area in acres.

4. A man takes out a life insurance policy of \$2500 for his wife and one of \$6000 for himself. If he pays \$31.04 premium on the first and \$37.50 on his own, what is the yearly charge for the insurance?

5. A property valued at \$24,600 is assessed for $\frac{3}{4}$ of its value at \$1.68 per hundred. Find the amount of the taxes.

6. What annual income will a man receive who invests \$5000 in a 6% stock at 115, brokerage at $\frac{1}{8}$%?

7. A speculator bought 70 shares of Chino Copper at $22\frac{3}{4}$ and sold it at $10\frac{1}{2}$. Allowing the usual brokerage, figure the loss.

8. I bought 200 shares of Lehigh Valley at $62\frac{1}{2}$ and sold them the same day at $65\frac{3}{8}$. Find my net gain if I paid brokerage for both buying and selling.

9. A corporation capitalized at \$820,000, lost money and was forced to levy an assessment of \$30,750. What per cent was each shareholder assessed?

10. A dealer imported 48,400 cigars invoiced at \$7.50 per hundred. If the duty on cigars is 25% ad valorem and \$4.50 per pound, what is the total duty, allowing 55 cigars to the pound?

11. What are the net proceeds of a sale of 220 shares of Amer. Woolen at $58\frac{3}{4}$, brokerage $\frac{1}{8}$%?

12. How many bricks each having a surface of $4'' \times 8''$ will be needed in paving a sidewalk 6′ wide and 180′ long?

13. A dealer marked a suit of furniture that cost him \$28.60 so as to gain 45%. He then discounted the marked price 15%. Find the selling price.

14. A speculator bought 150 shares of Balt. & Ohio at $97\frac{3}{4}$ and sold it at 101. What was his profit, allowing the usual brokerage?

15. Compute the interest on \$1660 invested for 2 yr. 8 mo. 15 da. at $3\frac{1}{2}\%$.

16. Compute the bank discount and the proceeds of a note for \$2200 for 90 da., discounted at 4%.

17. What per cent shall I make on my money if I pay $79\frac{7}{8}$ for 4% bonds?

18. A triangular sail 570 sq. ft. in area is 38 ft. high. What is the length of the base?

19. What sum must be invested in Imperial Japanese 6's, at $99\frac{5}{8}$, to return an annual income of \$2400, allowing for the brokerage?

20. A man's bank balance was \$1112.79. He drew checks for \$75.46, \$108.73, \$211.50, \$180, \$205, and \$23.49, and deposited \$506.13, \$14.50, \$229.83, \$100.15, and the interest on \$605 for 90 days at 6%. Find his present balance.

21. What will it cost to paint the outer surface of a reservoir tank 20′ in diameter and 50′ high, at 9¢ per sq. yd.?

22. What per cent is realized from an investment in 6% stock at $119\frac{7}{8}$, brokerage $\frac{1}{8}\%$?

23. A 60-day note for \$2450 dated December 10, 1918, with interest at 6%, was discounted January 9, 1919, at 6%. Find the discount.

24. If a man invests \$8987 in U. S. 4's at 102, brokerage $\frac{1}{8}\%$, what will be the annual income?

VII. MEASUREMENT

Raising to Powers. If a square is 6 in. on a side, what is its area? What is the area of a square 8 ft. on a side? 10 ft.? 15 ft.?

The product of a number by itself is the **square** of the number. In expressing arithmetical processes, we have seen that signs or symbols are a great convenience. The symbol to indicate that the square, or the second **power,** of 6 is to be taken, is 6^2. The symbol for the second power of 8 is 8^2 and is read "8 square." $10 \times 10 \times 10$, or 1000, is the third power of 10, and is written 10^3. The third power of a number is its **cube**. What is the fourth power of 2?

ORAL EXERCISE

1. Tell the square of each of the numbers from 1 to 12.

Tell the answers:

2. 10^2	5. $(\frac{1}{2})^2$	8. 5^3	11. $.02^3$
3. 9^2	6. 70^2	9. 3^4	12. $.4^2$
4. 14^2	7. 7^3	10. $(\frac{2}{3})^2$	13. $(1\frac{1}{2})^2$

14. 7^4 is read "seven fourth power." Read 11^3, $(\frac{2}{3})^4$, $(\frac{8}{15})^5$.

WRITTEN EXERCISE

1. A square is 47″ long. Find its area.
2. A cube of granite is 9′ wide. Find its volume.

Write the answers:

3. 53^2	6. 2.4^2	9. 120^3	12. 18^3
4. 6^4	7. 3^5	10. 2.5^2	13. $(\frac{7}{9})^3$
5. 11^3	8. $.64^2$	11. $(4\frac{1}{3})^2$	14. 2000^2

Calculate the area of a square whose side is:

15. 43 in. 16. 27 yd. 17. 35.6 ft. 18. .78 mi.

Finding Square Roots. If a square sheet of paper contains 49 sq. in., each side must be 7 in. in length. 49 being the *square* of 7, 7 is called the *square root* of 49; the symbol in this instance would be $\sqrt{49}$.

One of the two equal factors of a number is its **square root;** one of the three equal factors of a number is its **cube root.**

ORAL EXERCISE

Tell the square root of:

1. 9	3. 144	5. .64	7. 121	9. $\frac{1}{9}$
2. 25	4. 900	6. 169	8. .36	10. $\frac{9}{25}$

By Factoring. When a number is a perfect square, the square root may often be found by factoring the number.

Find the square root of 324:

$\sqrt{324} = \sqrt{2\times2\times3\times3\times3\times3}$
$= \sqrt{2\times3\times3\times2\times3\times3}$
$= \sqrt{18\times18} = 18$

Here we separate 324 into its factors and then arrange these factors into two square groups $2\times3\times3$ and $2\times3\times3$. Therefore $2\times3\times3$, or 18, is the square root of 324.

To find the square root of a perfect square, separate it into two equal factors.

ORAL EXERCISE

Tell the square root of:

1. 16	3. 36	5. 81	7. 900	9. 1600
2. 49	4. 64	6. 400	8. 256	10. 2500

WRITTEN EXERCISE

Find the square root of:

1. 225	4. 196	7. 2809	10. 3025
2. 576	5. 1225	8. 1089	11. 2601
3. 676	6. 1444	9. 2025	12. 2704

13. What is the square root of 2.56?

Find the side length of a square whose area is:

14. 484 sq. in.	**18.** 7.29 sq. ft.	**22.** 6.76 sq. yd.
15. 4.84 sq. in.	**19.** 2.84 sq. ft.	**23.** 169 sq. yd.
16. 961 sq. in.	**20.** 2500 sq. ft.	**24.** 729 sq. yd.
17. 324 sq. in.	**21.** 2304 sq. ft.	**25.** 10.89 sq. yd.

What is the square of 36? Since $36=30+6$, the square may be found as follows:

	$30+6$	36
	$30+6$	36
(30×6)	$+6^2$	216
$30^2+(30\times6)$		108
$30^2+2(30\times6)$	$+6^2=900+360+36=$	1296

In this way every number consisting of two or more figures may be regarded as made up of two units, and,

The square of a number is equal to the square of the tens, plus twice the product of the tens and the units, plus the square of the units.

Periods.

$1^2=1$	$10^2=100$	$100^2=10000$
$9^2=81$	$99^2=9801$	$999^2=998001$

From these examples we note that the square of a number contains twice as many figures or one less than twice as many figures as the number. Again if we separate the figures of the number into groups of two figures each, called **periods**, as in $\sqrt{36}=6$, $\sqrt{49\,00}=70$, $\sqrt{25\,00\,00}=500$, we may say

The number of figures in the square root of a number is the same as the number of periods of two figures each into which the number can be separated beginning at units.

NOTE. The last period at the left may contain but one figure.

Square Root. What is the square root of 7056?

$$\begin{array}{rrr} & & 70\ 56\ (84 \\ 8^2 = & & 64 \\ \hline 2\times80 & =160 & 6\ 56 \\ & 4 & \\ \hline & 164 & 6\ 56 \end{array}$$

If we separate the number into periods of two figures each beginning at the right, we see that there will be two places in the square root. 70 must contain the square of the ten's figure of the root.

Since the largest square in 70 is 64, then 8 is the ten's figure of the root. When we subtract the square of the tens, the remainder must contain twice the *product of the tens and the units, plus the square of the units.* Then 656 divided by twice the tens is approximately equal to the units. We use 160 as a trial divisor, which gives 4 as the unit's figure.

Since twice the tens are to be multiplied by the units, and the units also are to be multiplied by the units to secure the square of the units, we shorten the process by adding the units to the tens and then multiplying by the units. 4 is added to 160 and the sum 164 is multiplied by 4. The product 656 completes the square of 84.

WRITTEN EXERCISE

Find the square root of:

1. 5184	**5.** 1521	**9.** 5625	**13.** 3721
2. 4761	**6.** 3481	**10.** 1764	**14.** 7056
3. 2209	**7.** 1849	**11.** 3969	**15.** 1936
4. 4489	**8.** 2809	**12.** 5041	**16.** 9025

17. The area of a square field is 7744 sq. yd. What is the side length of the field?

Consider these cases, one with a decimal:

Find the square root of 45369: of 4.5369.

$$\begin{array}{rr} & 4\ 53\ 69(213 \\ & 4 \\ \hline 41 & 53 \\ & 41 \\ \hline 423 & 12\ 69 \\ & 12\ 69 \\ \hline \end{array}$$

$$\begin{array}{rr} & 4'.\ 53'\ 69(2.13 \\ & 4 \\ \hline 41 & 53 \\ & 41 \\ \hline 423 & 12\ 69 \\ & 12\ 69 \\ \hline \end{array}$$

In extracting the square root of decimals, we point off periods of two figures each beginning at the decimal point instead of at the right. When the number is not a perfect square, we annex zeros at the right and continue the process as far as we like.

The Square Root Process.

Separate the number into periods of two figures each, beginning at the units or at the decimal point.

Find the greatest square in the left-hand group and write its root for the first figure of the required root.

Subtract the square of this root figure from the left-hand period, and annex the second period for a dividend.

Take twice the root figure already found and divide the dividend by it. The quotient will be the second figure of the root.

Annex the quotient to the trial divisor and multiply by the units.

Subtract the product from the dividend and annex to the remainder the next period, proceeding as before until all the periods have been brought down. The result will be the square root.

WRITTEN EXERCISE

Extract the square root of:

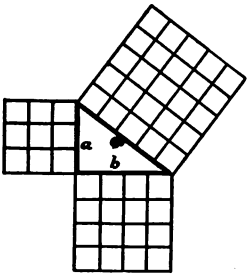
1. 3969	**5.** 12769	**9.** 755161	**13.** 822649
2. 70.56	**6.** 42849	**10.** 1036.84	**14.** 725904
3. 106.09	**7.** 324.61	**11.** 28900	**15.** 150.0625
4. 2.4649	**8.** 31.738	**12.** 194481	**16.** 414.9369

17. The area of a square is 44521 sq. in. How long is its side?

18. Find the length of a square park containing 21025 sq. rd.

19. Extract the square root of 7 to three decimal places.

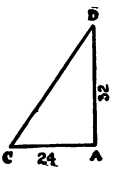
The Hypotenuse of a Triangle. The side opposite the right angle of a right triangle is called the **hypotenuse.**



Count the number of square units in the square described upon side *a*. What is the number of square units in the square described on side *b*? Count the number of square units in the square on the hypotenuse *c*. How does this number compare with the number of units in the sum of the square of the other two sides? We see from this that:

The square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides.

WRITTEN EXERCISE



1. Find the length of CD in this figure.
$CD^2 = AC^2 + AD^2$ or $CD^2 = 24^2 + 32^2$
Then $CD^2 = 576 + 1024 = 1600$, therefore
$CD = \sqrt{1600} = 40$

2. If the sides of a right triangle are 8″ and 15″, find the length of the hypotenuse. Draw the triangle and compare results.

3. Find the length of a fence extending diagonally across a rectangular field 270 ft. long and 144 ft. wide.

Find the hypotenuse when the other sides are:

4. 21 ft., 72 ft.
5. 45 yd., 24 yd.
6. 48 in., 36 in.
7. 35 rd., 12 rd.
8. 51 in., 68 in.
9. 203 ft., 396 ft.

10. If the base of a triangle is 10 ft. and the hypotenuse 26 ft., how would you find the length of the other side?

INDUSTRIAL APPLICATIONS

DRAWING TO SCALE

1. A rectangular drawing $8'' \times 3\frac{1}{2}''$ represents an armory floor. If the scale $= 1''$ to 20 feet, what are the dimensions of the floor?

2. If the scale is $\frac{1}{8}''$ to $1'$, what floor lengths will be represented by 1 in.? $\frac{1}{16}$ in.? $2\frac{1}{8}$ in.? $\frac{5}{8}$ in.? 5 in.? $3\frac{1}{4}$ in.? $6\frac{1}{4}$ in.? $2\frac{3}{4}$ in.? $\frac{1}{2}$ in.? $\frac{7}{8}$ in.?

3. A field, 75 yd. by 45 yd., is represented on a plan to the scale $\frac{1}{4}''$ to 10 yd. Make the drawing.

4. The living room in a house is 18 ft. 6 in. by 14 ft. 6 in. Show this on a plan to the scale $\frac{1}{4}''$ to 1 ft.

5. A drawing $16'' \times 20\frac{1}{2}''$ represents a city square. If the scale is $1''$ to 14 ft., what are the dimensions of the block?

6. An architect's plan of a cellar is drawn to the scale of $4''$ to $18'$. If the cellar is $28' \times 26'$, how large will the plan be?

7. A trap door is represented on the plan by a space $\frac{2}{3}'' \times 1''$. How large will the trap door be?

8. A coal bin is represented by a space $1\frac{1}{2}'' \times 1\frac{3}{4}''$. How large will the bin be?

Using the scale $\frac{1}{4}''$ to $1''$ represent the following:

9. A kitchen floor, $12'\ 6'' \times 15'\ 3''$.
10. The floor plan of a porch $17' \times 11'\ 6''$.
11. The floor plan of a pantry $6'\ 8'' \times 5'\ 3''$.
12. The floor plan of a hall $14'\ 3'' \times 7'\ 4''$.
13. The floor plan of a stall $15'\ 4'' \times 6'\ 3''$.
14. The floor plan of a shop $18'\ 6'' \times 24'\ 9''$.
15. The floor plan of a garage $35'\ 8'' \times 20'\ 7''$.

PLASTERING

Plastering is usually estimated by the square yard and is figured to the nearest square yard.

1. At 24¢ per sq. yd. what will it cost to plaster a room 20′×16′ and 10′ high, 15 sq. yd. being deducted for openings?

Distance around room $= 2\times(20'+16') = 72'$
Total wall area $= (10\times72)$ sq. ft. $=$ 720 sq. ft.
Area of ceiling $= (20\times16)$ sq. ft. $=$ 320 sq. ft.
Total area 1040 sq. ft.
Total area in sq. yd. $= (1040\div9)$ sq. yd. $=$ $115\frac{5}{9}$ sq. yd.
Deducting for openings 15 sq. yd.
$100\frac{5}{9}$ sq. yd. or 101 sq. yd.
Cost at \$.24 per sq. yd. $= 101\times\$.24 = \$24.24$.

2. How many sq. yd. of plaster will be needed for the following rooms, making no allowances:

Parlor 19′×15′ and 10′ high.
Dining room 18′×15′ and 9′ high.
Bedroom 20′×16′ and 11′ high.

3. Find the cost of plastering each room above at 35¢ per sq. yd.

4. At 25¢ per sq. yd. estimate the cost of plastering a room 16′×12′ and 9′ high, allowing 12 sq. yd. for openings.

5. At 35¢ per sq. yd. what will it cost to plaster a room 24′×15′ and 10′ high, deducting the area of 2 doors each 8′×3′?

At 32¢ per sq. yd. figure the cost of plastering the following rooms:

6. 25′×20′ and 15′ 6″ high, allowing 18 sq. yd.

7. 18′×12′ 6″ and 10′ high, allowing 10 sq. yd.

8. 15′×10′ 6″ and 9′ 6″ high, allowing 12 sq. yd.

9. Which will take the more plaster, a room 22′×18′ and 9′ 6″ high or one 21′×17′ and 11′ 6″ high?

PAINTING

1. Find the cost of painting the walls and ceiling of a room $25' \times 18'$ and $10'$ high at $12¢$ a sq. yd.

At $7¢$ a sq. yd. what will it cost to calcimine the walls and ceiling of these cellars:

2. $18' \times 18'$ and $9'$ high.
3. $38' \times 27'$ and $10'$ high.
4. $26' \times 23'$ and $7'$ high.
5. $26' \times 23'$ and $8'$ high.
6. $28' \times 20'$ and $7'$ high.
7. $32' \times 22'$ and $8\frac{1}{2}'$ high, allowing 4 sq. yd. for openings.
8. $20' \times 16\frac{1}{2}'$ and $8'$ high, allowing 6 sq. yd. for openings.
9. Find the cost of shellacking these floors at $12¢$ a sq. yd.:
   Parlor $22' \times 18'$ and $10'$ high.
   Library $20' \times 16'$ and $10'$ high.
   Dining room $24' \times 18'$ and $12'$ high.
   Bedroom $18' \times 14'$ and $11'$ high.
   Reception hall $10' \times 32'$ and $12'$ high.
10. At $12¢$ a sq. yd. what will it cost to paint the wall and ceiling of the bedroom in Ex. 9?
11. The library in Ex. 9 has woodwork around the wall base $3\frac{1}{2}'$ high. Find the cost of varnishing it at $12¢$ a sq. yd.
12. Estimate the cost of painting a room $30' \times 22' \times 9'$ at $6¢$ a sq. yd. for the floor and $12¢$ a sq. yd. for the walls and ceiling, allowing for 10 sq. yd. of openings.
13. At $25¢$ a sq. yd. what will it cost to paint the outside of a house $40' \times 25'$ and $45'$ high, with two coats of paint, allowing for 20 sq. yd. of openings?
14. The curved surface of a tank 7 ft. 3 in. in diameter and 48 ft. 6 in. long, is to be painted. How many sq. ft. of surface are to be painted?

PAPERING

Single rolls of wall paper are 8 yd. long and 18 in. wide. Parts of rolls are not sold. The number of strips will equal twice the perimeter of the room in yards.

1. How many rolls of paper are needed to paper the walls of a room $21' \times 18'$ and $8'$ high?

Perimeter of room $= 2 \times (21' + 18') = 78'$ or 26 yd.
Number of strips $= 2 \times 26 = 52$
Number of strips from a roll $= 24 \div 8 = 3$
Number of rolls $= 52 \div 3 = 17\frac{1}{3}$, or 18 rolls.

How many rolls will be needed to paper the following rooms:

2. $26' \times 16' \times 9'$

3. $18' \times 13' \times 10'$

4. Figure the number of rolls needed for the walls and ceiling of a room $18' \times 16' \times 10'$, the ceiling paper to run crosswise.

5. At 35¢ a roll, what will the paper cost for a room $35' \times 30' \times 11'$?

6. A room is $10' \times 9\frac{1}{2}' \times 9'$. What will the paper cost at 24¢ a roll, if 4 strips are deducted for openings?

7. How many double rolls of paper, each 16 yd. long, will be required for the walls of a room 31′ long and 25′ 4″ wide, and 14′ high?

8. What will oilcloth paper, at $1.10 per roll, cost for a kitchen 14′ long, 12′ wide, and 10′ high, deducting 2 rolls for tubs, stove, etc.?

9. At 30¢ a roll, what will the paper cost for a room 20′ long, 21′ wide, 12′ high, if $1\frac{1}{2}$ rolls are allowed for doors and windows?

10. Tell the cost of paper for the walls and ceiling of a room 18′ 6″ long, 15′ 6″ wide, and 12′ high, at 60¢ a roll, the ceiling paper to run crosswise.

CARPETING

Carpet is sold by the yard, and made either 1 yard wide or $\frac{3}{4}$ yd. wide.

1. What will it cost at \$1.25 a yd. to carpet a room 18′ by 15′, allowing $\frac{1}{6}$ yd. on each strip, except the first, for matching?

Number of strips $= 5 \div \frac{3}{4} = 6\frac{2}{3}$ or 7 strips

Since $\frac{1}{6}$ yd. is allowed on each strip except the first, we have

6 strips, each $6\frac{1}{6}$ yd. long	= 37 yd.
1 strip	= 6 yd.
Total length	43 yd.

Cost is $43 \times \$1.25 = \$53.75$

2. A room 28′ by 21′ is to be carpeted with material $\frac{3}{4}$ yd. wide at \$1.50 per yd. Find the cost.

3. If carpet is 27″ wide and there is a waste of $\frac{1}{3}$ yd. in all, how much will it cost at $\$.87\frac{1}{2}$ a yd. to carpet a room 24′ × 17′?

4. How many strips of carpet $\frac{3}{4}$ yd. wide, are required to cover a floor 22′ long and 19′ wide if the strips run lengthwise? If they run crosswise?

5. Figure the more economical way to lay carpet in a room 26′ × 23′, the carpet being $\frac{3}{4}$ yd. wide.

6. A room 20′ × 16′ is to be carpeted with carpet $\frac{3}{4}$ yd. wide worth \$.80 a yd. There will be a waste of $\frac{1}{6}$ yd. in all. Which way will it be cheaper to run the strips, lengthwise or crosswise? How much cheaper?

7. A hotel exchange is to be carpeted with material $\frac{3}{4}$ yd. wide at \$1.75 a yd., strips running lengthwise, and $\frac{1}{2}$ yd. allowed on each strip for matching. Estimate the cost if the floor is 30′ × 24′.

Allowing $\frac{1}{6}$ yd. on each strip except the first, find the cost of carpeting these rooms, carpet being 27″ wide:

8. 16′ × 13′ @ \$1.25
9. 15′ × 12′ @ \$1.20
10. 18′ × 14′ @ $\$.87\frac{1}{2}$
11. 10′ × 8′ @ \$.80

BOARD MEASUREMENT

The unit of measurement of lumber is the **board foot,** which is the amount of lumber in a board 1 ft. long, 1 ft. wide, and 1 in. thick. A board 12′ long, 1′ wide, 1″ thick contains 12 board feet; a board 12′×1′ ×2½″ contains 30 board feet.

Tell the number of board feet in boards:

1. 8′×3″ and 1 in. thick.
2. 20′×6″ and 1 in. thick.
3. 12′×14″ and 2 in. thick.
4. 12′×12″ and 1½″ thick.
5. 15′×16″ and 2″ thick.
6. 18′×18′ and 2¼″ thick.
7. How many board feet are there in a plank 18′ long, 1½′ wide, and 1½″ thick?
8. How many board feet in 10 beams 20′×6″×4″? In 17 beams?
9. Find the cost of 40 pine boards 24′×9″×1″ at $18 per M.
10. Tell the cost of 75 cedar joists 12′×11″×4″ at $25 per M.
11. Find the cost of 150 pieces of board, each 15′×12½″ ×1½″ at 8¢ per ft.
12. If a plank 12′×9″×2″ is cut into boards 1″ thick, how many sq. ft. will they cover?
13. Estimate the cost of the labor in laying a hardwood floor 20′×24′ at $8 per thousand square feet of surface.
14. What will be the cost of flooring a room 22′×36′, with lumber 1″ thick at $30 per M?
15. Find the cost of the flooring for a room 48′×40′ at $4.50 per thousand sq. ft., allowing ⅛ of the floor area for loss in cutting and overlapping.
16. At $7.20 per 1000 sq. ft., figure the cost of matched flooring for a reception hall 75′×50′. If it takes two men 8 hours each at 60¢ an hour to lay the floor, compute the total cost.

PAVING AND EXCAVATING

Estimates for pavements, sidewalks, and roadbeds are based on the square yard or square foot. The cost of excavation is based on the cubic yard.

1. What will it cost, at 28¢ per sq. ft., to construct a sidewalk $6\frac{1}{2}'$ wide and 98′ long?

2. A concrete foundation for a pavement is 50′ wide and 924 yd. long. How much will it cost at \$.90 per sq. yd.?

At \$2.10 per sq. yd. what will it cost to pave with brick the following lengths of street and sidewalk:

3. 180 yd. × 9′
4. 680′ × 12′
5. 520′ × 8′ 6″
6. 820′ × 6′ 4″
7. 410 yd. × 3 yd.
8. 500 yd. × 11′ 6″

9. A street 825′ long and 32′ wide can be asphalted at a cost of \$2.25 per sq. yd., or paved with brick at \$1.70 per sq. yd. How much cheaper will the brick pavement be?

10. To prepare it for asphalt paving, a street 830 yd. long and 48′ wide is excavated to an average depth of 15 in. How many cubic yards of earth are removed? What will this cost at 45¢ per cu. yd.?

Find the cost of digging the following cellars at the price given per cu. yd.:

11. 60′ × 50′ × 9′ @ \$.50
12. 48′ × 30′ × 6′ @ \$.42
13. 42′ × 38′ × $6\frac{1}{2}'$ @ \$.42
14. 35′ × 30′ × 8′4″ @ \$.40

15. How much will it cost at 20¢ per cu. yd., to remove snow from a city street 1 mi. long and 30′ wide, when the snow is 6″ deep?

16. If a dirt car can carry 18 cu. yd. of earth, how many carloads will be moved in excavating a space 567′ × 84′ and 24′ deep?

17. A trench is 620′ long, 18″ wide, and 6′ 6″ deep. Find the cost of excavation at \$1.25 per cu. yd.

THE CAPACITY OF TANKS AND BINS

1 gallon	= 231 cu. in.	$7\frac{1}{2}$ gal. = 1 cu. ft.
1 bushel	= 2150.4 cu. in.	1 bu. = $1\frac{1}{4}$ cu. ft.
1 cu. ft. of water	= $62\frac{1}{2}$ lb.	1 gal. = $8\frac{1}{3}$ lb.
$4\frac{1}{2}$ cu. ft.	= 1 barrel	$31\frac{1}{2}$ gal. = 1 barrel

1. A tank is $12' \times 4' \times 4'$. How many gal. will it contain?

Compute the contents in gal. of the following tanks:

2. $3' \times 4' \times 8'$
3. $4'\ 5'' \times 3'\ 1'' \times 2'\ 6''$
4. $2'\ 6'' \times 3'\ 6'' \times 10'$
5. $15'' \times 12' \times 10''$

6. Compute the weight of the water in a tank $8' \times 6'\ 6'' \times 5'$ when the tank is $\frac{3}{4}$ full.

7. How many barrels of oil will be contained in a tank $10' \times 7' \times 9'$?

8. Find the weight of 147 gallons of water.

9. A cylindrical tank is 15′ high and the inside diameter of the base is 4′. How many gal. will it contain?

10. About how many cu. ft. of water are there in a tank containing 9000 gal.?

11. How many cu. in. in $23\frac{1}{2}$ bu.?

12. In 132 bu. how many cu. ft. are there?

13. How many bu. will be contained in a space of 900 cu. ft.?

14. A rectangular bin is $20' \times 8' \times 5'$. How many bushels will it hold?

15. If a ton of coal occupies about 35 cu. ft., about how many tons can be stored in a bin $18' \times 8'\ 6'' \times 6'$?

16. How many bu. will a bin $12' \times 7'$ hold if 4′ deep?

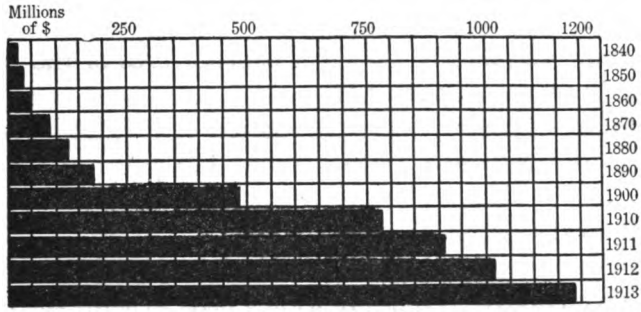
17. A wagon body is 10′ 6″ long, 1 yd. wide, and 30″ high. How many cu. ft. will it contain?

18. A bushel of corn weighs 56 lb. Figure the weight of the corn in a bin $8' \times 4' \times 3'$.

19. A box is 7′ 4″ long, 2′ wide, and 3′ 4″ deep. How many cu. ft. does it contain?

FORMS OF GRAPHS

We can often make others grasp more readily and understand more clearly the practical significance of figures by using a diagram or a graph. A " graphic " illustration serves to visualize certain relationships otherwise difficult to comprehend.



For example, however clearly one may grasp the relative values of the manufactured goods exported from the United States, when one reads that the total was $20,000,000 in 1840, $25,000,000 in 1850, $50,000,000 in 1860, etc., and $1,190,000,000 in 1913, the great increase in our manufactures seems almost vivid to us when it is represented in the form of graph as above. Here each square represents $50,000,000.

WRITTEN PROBLEMS

1. Draw a diagram in which each square shall represent a production of 5 million bushels, so as to show graphically the wheat production of the following states: Oklahoma, 15 millions; Indiana, 30 millions; Kansas, 38 millions; S. Dakota, 44 millions; Ohio, 50 millions; N. Dakota, 59 millions; Minnesota, 75 millions.

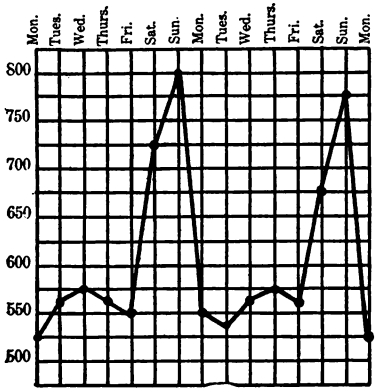
2. Construct a graph to show world coal production in tons: Great Britain, 290 millions; Austria-Hungary, 55 millions; United States, 420 millions; Germany, 240 millions; Russia, 29 millions; Belgium, 24 millions.

3. Show graphically the population of the continents: North America, 110 millions; South America, 35 millions; Europe, 400 millions; Australia, 3 millions; Asia, 910 millions; Africa, 175 millions.

4. Show graphically the chief expenditures of the United States as given on page 123.

5. Show by a graph the production of plantation rubber in tons during these years; 1905, 140 tons; 1906, 510; 1907, 1000; 1908, 1800; 1908, 3600; 1910, 8200; 1911, 14,100; 1912, 28,500; 1913, 42,000.

Besides being used to show relative quantities such as those given above, graphs are widely used to show the nature or degree of variations or numerical changes. They can illustrate changes in rainfall, temperature, pressure, population, transportation, etc.



This graph shows the variation in the number of passengers carried by a ferry-line during each day of a two weeks' period. The successive days are represented on the horizontal lines and the number of passengers on the vertical lines; as, Monday 525; Tuesday 560, etc.

WRITTEN EXERCISE

1. In Sept. there were 2025 pupils in a school; in Oct. 2215; Nov. 2250; Dec. 2210; Jan. 2270; Feb. 2300; Mar. 2350; Apr. 2400; May 2270; June 2120. Make a graph showing the changes in average attendance during the year.

2. Make a graph illustrating a newspaper record of daily temperature as follows: 8 A.M. 68°; 9 A.M. 70°; 10 A.M. 72°; 11 A.M. 73°; 12 M. 76°; 1 P.M. 78°; 2 P.M. 79°; 3 P.M. 81°; 4 P.M. 79°; 5 P.M. 78°; 6 P.M. 76°; 7 P.M. 72°; 8 P.M. 71°; 9 P.M. 70°; 10 P.M. 68°; 11 P.M. 66°; 12 M. 68°; 1 A.M. 68°; 2 A.M. 68°; 3. A.M. 67°; 4 A.M. 67°; 5 A.M. 67°; 6 A.M. 68°; 7 A.M. 68°.

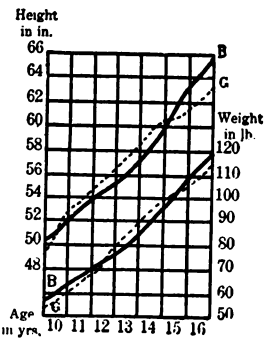
SALES	EXPENSES
Jan.....$715	*$505*
Feb.....$730	*$570*
Mar....$785	*$610*
Apr.....$695	*$585*
May....$700	*$570*
June... $685	*$565*

3. A storekeeper records his sales and expenses for six months as follows:

To illustrate the relation between sales and expenses it will be necessary to use two lines. Make the lower one dotted.

4. A boy obtained the following averages in his monthly ratings: Feb. 62%; Mar. 58%; Apr. 76%; May 78%; June 83%. Make a graph of the term's record.

5. On this graph the upper line shows the average changes in height of boys and girls, while the lower lines show the average changes in weight for boys and girls. During what periods is the weight shown to change most rapidly? The height?



ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
1.	38 @ \$.50	80 @ \$.70	70 @ \$.60	$7-3\frac{1}{2}$	$24\times12\frac{1}{2}$
2.	39 @ $.66\frac{2}{3}$	52 @ .25	35 @ .20	$3-1\frac{2}{3}$	$27\times11\frac{1}{9}$
3.	64 @ $.12\frac{1}{2}$	70 @ .90	80 @ .05	$6-4\frac{2}{5}$	$42\times14\frac{2}{7}$
4.	66 @ $.16\frac{2}{3}$	32 @ .75	15 @ .80	$9-3\frac{3}{7}$	$66\times16\frac{2}{3}$
5.	48 @ $.37\frac{1}{2}$	17 @ .30	42 @ $.14\frac{2}{7}$	$2-1\frac{1}{8}$	$18\times33\frac{1}{3}$
	Find the number of which:			*Add:*	
6.	8 is $\frac{1}{2}$%	60 is $83\frac{1}{3}$%	80 is 200%	57+83	72+85
7.	20 is 5%	35 is $62\frac{1}{2}$%	40 is 250%	26+38	49+53
8.	24 is 40%	11 is $12\frac{1}{2}$%	60 is 125%	15+21	32+25
9.	72 is 12%	12 is $12\frac{1}{2}$%	30 is 150%	58+93	48+53
10.	52 is 25%	75 is 60 %	22 is $16\frac{2}{3}$%	32+41	27+19
	What per cent of:		*Find values:*		
11.	90 is 30?	24 is 15?	28 @ \$.25	94+74	45+63
12.	40 is 12?	36 is 24?	40 @ $.62\frac{1}{2}$	65+39	29+17
13.	35 is 10?	20 is 6?	55 @ \$.40	17+18	27+41
14.	32 is 20?	24 is 9?	64 @ $.87\frac{1}{2}$	69+54	47+38
15.	18 is 15?	36 is 24?	32 @ $.06\frac{1}{4}$	56+14	43+47

Count the change:

	\$1.00	\$2.00	\$10.00	\$5.00	\$20.00
16.	\$.89	\$1.43	\$ 5.82	\$3.49	\$10.41
17.	.32	.79	4.16	.75	3.80
18.	\$.69	1.81	3.37	4.01	.68
19.	.18	.26	2.05	3.39	5.46
20.	.24	1.13	1.89	.25	17.17

21.	? rd. =1 mi.	$5\frac{1}{2}$ lb. =? oz.	$8\frac{1}{2}$ doz. =?	$6\frac{1}{4}+3\frac{1}{2}$	$8\frac{1}{7}-3\frac{3}{7}$
22.	5 pk. =? qt.	5 gal. =? pt.	30 mo. =?	$4\frac{5}{6}+7\frac{2}{3}$	$9\frac{3}{8}-6\frac{4}{9}$
23.	1 Km. =? mi.	10 rd. =? ft.	12 doz. =?	$2\frac{1}{4}+8\frac{7}{8}$	$7\frac{1}{2}-4\frac{3}{8}$
24.	1 m. =? in.	$3\frac{1}{2}$ bu. =? pk.	£$3\frac{1}{2}$ =? \$	$7\frac{3}{10}+6\frac{4}{5}$	$8\frac{1}{10}-7\frac{2}{5}$
25.	1 Kg. =? lb.	? gal. =2 bbl.	3 M. =? \$	$8\frac{3}{11}+2\frac{3}{11}$	$9\frac{1}{12}-5\frac{1}{3}$

GENERAL WRITTEN PROBLEMS

1. Which is better and how much better: to buy goods for \$268.75 net, or with discounts of 20, 10, and 5% from a list price of \$400?

2. How many pieces of felt each 18″ long, can be cut from a piece containing $30\frac{3}{4}$ yd., and what fraction of a yd. will be left?

3. How much premium must be paid on a fire insurance policy of \$4500 at the rate of \$1.38 per hundred?

4. How much will 600 bbl. of apples cost the buyer bought at \$3.80 per bbl., with a commission of $1\frac{1}{2}$% added?

5. A cylindrical tank is 7′ in diameter and 10′ high; how many gal. does it hold? (One gal. = 231 cu. in.)

6. A commercial traveler receives a weekly salary of \$30, and in addition a 3% commission on his sales. If his sales amount to \$6000 per month, how much is his monthly income?

7. If 3 men can do a piece of work in $9\frac{1}{3}$ da., how long will it take 10 men to do the same work?

8. The foot of a 37-ft. ladder is 12 ft. from the wall of a building against which the top of the ladder rests. How high does the ladder reach on the wall?

9. A wholesale dealer purchased 1000 bottles of medicine at $87\frac{1}{2}$¢ per bottle plus the internal revenue tax of $1\frac{1}{8}$¢ per bottle. For how much must the medicine be sold per bottle to gain 10% profit, if the total selling cost is \$13.75?

10. A note of \$824, given Feb. 16, 1914, for 4 mo. with interest at 6%, was discounted April 10, at 6%. Find the proceeds.

11. If a man pays a tax of \$68.75 upon a house assessed for \$5500, what is the tax rate?

12. An investor bought 36 shares of stock at $110\frac{1}{2}$ and sold them at $117\frac{3}{4}$, brokerage $\frac{1}{8}\%$ on each transaction. What was his total gain?

13. To how much will the interest amount on \$290 for 4 yr. 2 mo. 24 da. at 4%?

14. How much will it cost to carpet a room 48′ by 36′, the strips being 27 in. wide and running lengthwise, if the carpet costs \$.60 a yd.?

15. At 80¢ a cubic yard, what will it cost to excavate a cellar 26′ long, 18′ wide, and 8′ deep?

16. The tax rate in a city was \$2.02 per hundred. Find the tax at that rate on property assessed for \$6500.

17. Find the area of a circle whose circumference is 50.2656 feet.

18. How many yd. of carpet 27 in. wide will be required for a hall 11 ft. 3 in. wide and 64 ft. long, if the strips run lengthwise and there is no waste in matching? What will the carpet cost at \$1.50 per yd.?

19. A square lot has an area of 6889 sq. ft. How many feet long is one side?

20. The shorter side of a rectangular field is 30 rd.; the diagonal is 50 rd. Calculate in acres the area of the field.

21. During ten successive years from 1906=1915 the attendance at the World's Championship Series expressed in thousands was 91.7, 99.8, 78, 62.2, 145.2, 125.2, 179.8, 252, 150.9, 143.3. Show on a graph the attendance changes.

22. The base of a triangle is 207 ft.; the hypotenuse is 305 ft. Find the altitude.

23. How long a ladder will be required to reach a window 24′ from the ground, if the foot of the ladder is 10′ from the building and the ground is level?

24. A canister used for shipping pulverized coffee is $14\frac{1}{2}'' \times 10\frac{1}{2}'' \times 9''$. How many cubic inches in its contents?

VIII. BUSINESS FORMS AND HOUSEHOLD ACCOUNTS

1. A family's receipts for a month were \$145. The expenditures were as follows: Rent, \$32; coal and lighting, \$5.70; meat, \$14.23; groceries, \$24.16; milk and butter, \$6.75; ice, \$1.80; laundry, \$8.75; clothing, \$18.45. Supply dates, arrange, and balance the monthly cash account.

2. Balance the following family cash account, supplying dates of a three weeks' period. On hand, \$28.15. Receipts: \$18, \$18, \$18, \$6.50. Expenses: \$8.25, \$22.40, \$11.08, \$2.98, \$13.79, \$.39, \$1.15, \$6.25, \$4.83, \$.69, \$2.14.

3. Mr. Hill finds that his household expenses for a month are as follows: groceries, \$36.16; clothing, \$22.45; rent, \$50; meat, \$22.17; laundry, \$12.05; gas, \$3.72; insurance, \$3.36; butter, milk, and eggs, \$10.14; sundries, \$14.68; carfare, \$4.25; papers, \$.86; amusements, \$16.50; maid, \$28.25. During this month his total income was \$260.60. Balance the account.

4. Mrs. Robertson bought furniture for a library from Frederick B. Loeser & Co. on August 14 as follows: library table, \$42.50; lamp, \$11.25; rug, \$14.35; book-case, \$15.60; small table, \$5.50; book-rack, \$7.25; 2 statues @ \$3.75; 2 pairs curtains @ \$3.25; 3 chairs @ \$4.40. Make out the bill she received, and discount it at 5%.

5. A housewife found that she was buying $41\frac{1}{4}$ lb. of meat every month at an average cost of \$.224 per lb. She was able to substitute other foods for the meat at an average cost of \$6.03 a month. How much did she save yearly by doing this?

6. Mrs. Miller put up 8 doz. jars of strawberry jam. She used 1 pint of berries and $\frac{1}{2}$ lb. of sugar to each jar. If the sugar cost $9\frac{1}{2}$¢ a lb. and the berries 12¢ a qt., find the total cost of her preserves.

7. Mrs. Miller ordered from Park & Davis, a 5-lb. caddy of mixed tea @ \$.66; a quart jar of strained honey @ \$.69; 2 boxes table salt @ \$.09; 6 pkgs. Royal Lunch biscuits @ \$.09; 1 can olives @ \$.48; 2 lb. prunes @ \$.13; 2 cans salmon @ \$.21; 3 cans tomatoes @ \$.13; 3 pkgs. washing powder @ \$.14; $4\frac{1}{2}$ lb. butterine @ \$.32. Make out a bill for these articles.

8. On November 1, Mr. Brensler's gas meter recorded 17,100 cu. ft. On October 1, it had recorded 14,800 cu. ft. How many cu. ft. of gas had he used during October? At 80¢ per M what was the amount of his gas bill?

9. In one month a family uses $1\frac{3}{4}$ tons of coal at \$8.70 per ton and 3300 cu. ft. of gas at \$1.00 per M. If the father's monthly salary is \$135, what per cent of it does he pay for fuel and light?

10. In preparing a dinner for four persons, a girl used 3 lb. beef @ \$.21; 6 potatoes costing \$.09; 1 head of lettuce @ \$.05; salad dressing, \$.03; 1 loaf bread @ \$.05; cornstarch and sugar, \$.08; 1 pint milk, \$.04. Find the total cost of the dinner and the average cost per person.

11. A family had an income of \$3000 a year. The average monthly expense for rent was \$50; food, \$70; clothes, \$43.34; heat and light, \$7.50; laundry, \$2.48; recreation, \$10; insurance and savings, \$20; repairs and help, \$35. How much was saved every month? How much during the year? What per cent of the monthly income was spent for rent? For food? For heat and light? For repairs and help?

IX. SIMPLE EQUATIONS: OPTIONAL WORK

1. A literary society has 56 members. The number of girls is three times the number of boys. How many girls and boys are members?

2. A mechanic wishes to cut a piece of pipe $8\frac{1}{3}$ ft. long into two parts whose difference in length will be 52 in. Into what lengths shall he cut the pipe?

3. The price of a certain automobile was reduced 14% one season, and was then sold for \$2472.50. What was the price before the reduction?

4. If a torpedo boat travels 93.72 mi. in 3.3 hours, how far would it travel in 5 hr. at the same rate?

5. A and B together have \$70; C has twice as much as B and A has three times as much as C. How much has each?

6. In a shipment of oranges, 20% of the consignment was damaged in transit. If 312 cases arrived in good condition, how many were shipped?

7. How would you divide 104 library books between two classes so that one class would have 7 times as many books as the other?

8. A woman paid a bill of \$17.20 for gasoline at 6¢ a qt. and kerosene at 19¢ a gal., buying the same number of gal. of each. How many gal. of each oil did she buy?

9. A rectangular field has a length 48 yd. longer than its width, and its perimeter is 384 yd. Find the dimensions.

10. After a discount of 25% of the list price had been deducted, and the remainder discounted $33\frac{1}{3}$%, a clock cost \$4.10. Tell the list price.

11. A number is increased by 70 and the sum divided by 14 gives 8 for the quotient. Find the number.

12. A furniture dealer added 10% selling charges to the cost price of a library table. He computed his profit at 30% of the total cost and sold the table for $32.89. How much did he pay for it?

13. At what rate will $3200 amount to $3616 in 3 yr. 3 mo.?

14. What sum put at interest for $2\frac{1}{2}$ yr. at 4% will yield an interest of $500?

15. How long a time must I have $600 out at interest at 3% in order to have it yield $72?

16. If a speculator paid $4914 for the purchase of stock at $58\frac{3}{8}$, plus the usual brokerage, how many shares did his broker buy for him?

17. An automobile owner pays $49 premium for insuring a machine for $\frac{4}{5}$ of its value at $1.75 per hundred. What is the value of the car?

18. A real estate operator wishing to sell a piece of property, asked 25% more than it cost him and sold it at a discount of 16% from his asking price; he gained $780 by the transaction. What did the real estate cost him and what was his selling price?

19. An investor paid $4814 for 5 building lots to an operator who thereby gained 16% on what the lots cost him. How much did the agent pay per lot?

20. A farm of 60 A. was sold at a loss of $1260, or 14% of the cost. Find the selling price per A.

21. A manager, paying repair bills, finds that the second bill was $8 more than the first and the third $7 more than the second. If the three bills totaled $70.40, what was the amount of each?

ORAL DRILL EXERCISE

	A	*B*	*C*	*D*	*E*
	Read:		*Tell the answers:*		
1.	LXVII	MDVII	$8\times\frac{2}{7}$	$1.473-.5$	$11.12+$2.46
2.	CDI	MCMVI	$9\times\frac{7}{8}$	$.542-.25$	$12.17+$9.83
3.	XLIX	DLXVI	$7\times1\frac{1}{2}$	$84.3-.24$	$ 7.79+$8.11
4.	LXXXIV	CMLX	$6\times\frac{4}{15}$	$2.601-1.31$	$14.62+$7.49
5.	CIV	MDCVII	$12\times\frac{3}{5}$	$.0087-.0009$	$13.20+$3.92
	Change to common fractions:			*State results:*	
6.	.04	.6	.375	$3.1+.841$	$15.49-$4.90
7.	1.5	2.25	.18	$.567+2.41$	$17.03-$8.86
8.	.8	.12	$.14\frac{2}{7}$	$76.2+.891$	$12.65-$6.39
9.	.625	.15	.875	$47.47+5.83$	$11.19-$3.40
10.	.025	.0625	.24	$.0091+5.62$	$15.10-$5.68
	Find values:				
11.	$\frac{2}{7}\times56$	$\frac{9}{8}+\frac{8}{8}$	$\frac{4}{5}-\frac{3}{10}$	$.56\div.7$	$11.19+$9.91
12.	$\frac{2}{3}\times93$	$\frac{1}{8}+\frac{1}{9}$	$1\frac{1}{2}-\frac{3}{4}$	$.63\div.9$	$ 7.60+$3.48
13.	$\frac{2}{3}\times96$	$3\frac{2}{3}+\frac{2}{3}$	$1\frac{3}{7}-\frac{4}{7}$	$.24\div.2$	$12.04+$9.25
14.	$\frac{2}{9}\times81$	$1\frac{5}{7}+\frac{5}{7}$	$1\frac{3}{4}-\frac{1}{2}$	$40\div.04$	$10.23+$3.16
15.	$1\frac{5}{12}\times120$	$1\frac{1}{3}+\frac{1}{6}$	$1\frac{2}{3}-\frac{1}{2}$	$86.4\div.08$	$10.80+$7.16
16.	$\frac{7}{8}$ of 320	$\frac{3}{5}\div\frac{4}{5}$	$1\frac{1}{12}-\frac{1}{4}$	$152\times12\frac{1}{2}$	$8.04-$5.63
17.	$\frac{3}{7}$ of 84	$\frac{7}{8}\div\frac{3}{5}$	$3\frac{2}{5}-\frac{3}{10}$	$196\times14\frac{2}{7}$	$6.31-$2.18
18.	$\frac{2}{3}$ of 84	$2\frac{1}{2}\div\frac{3}{4}$	$2\frac{1}{8}-\frac{3}{4}$	$138\times16\frac{2}{3}$	$3.14-$1.75
19.	$\frac{1}{5}$ of 85	$1\frac{3}{4}\div\frac{7}{8}$	$1\frac{5}{6}-\frac{5}{6}$	$981\times11\frac{1}{9}$	$7.15-$5.60
20.	$\frac{1}{4}$ of 84	$4\frac{1}{2}\div\frac{1}{2}$	$1\frac{1}{9}-\frac{2}{3}$	$966\times33\frac{1}{3}$	$5.40-$4.48
21.	36 @ $.33\frac{1}{3}$	3)69	26×4	$.45\div5$	$5.46+$3.31
22.	36 @ $.11\frac{1}{9}$	5)115	17×8	$.018\div6$	$2.39+$4.68
23.	36 @ $.12\frac{1}{2}$	6)78	28×4	$.273\div3$	$6.68+$7.47
24.	36 @ 1.75	8)104	17×6	$.025\div5$	$1.49+$5.33
25.	36 @ 1.50	9)135	16×9	$6.25\div5$	$4.23+$6.91
26.	36 @ 1.25	9)108	19×7	$1.86\div3$	$3.38+$2.51
27.	36 @ $1.83\frac{1}{3}$	2)144	144×3	$54.6\div6$	$4.72+$4.72
28.	36 @ $1.16\frac{2}{3}$	3)128	273×2	$.637\div7$	$6.13+$7.72

GENERAL WRITTEN PROBLEMS

1. Find the number of cubic feet of ice on an artificial pond 17 rd. long and 6 rd. wide, the ice being $1\frac{1}{2}$ ft. thick.

2. Find the bank discount and the proceeds of a 60-day note for \$1680 with interest at 5%, discounted 10 days after it was drawn at 4%.

3. The face of an insurance policy was \$5692 and the premium paid was \$42.69. Find the rate of insurance.

4. A pail 12″ in diameter and 15″ deep, is full of water; find the weight of the water. (1 cu. ft. of water = $62\frac{1}{2}$ lb.)

5. The diagonal of a square is 30 ft.; figure to two decimal places the length of one side.

6. George can shovel the snow from a walk in 25 minutes; Henry can do the same work in 30 minutes. How long will it take them to do the work together?

7. During an eight-months period of one year Great Britain bought \$64,342,561 worth of lubricating oils, against \$61,347,618 worth in the same period the preceding year. By how much had the exports increased in the year? Find the average monthly value of the oils exported for each year.

8. A man sold through a broker 176 shares of stock at $96\frac{1}{2}$, brokerage $\frac{1}{8}$%. What sum should the broker remit?

9. The assessed valuation of property in a village was \$3,200,000. In order to raise \$16,800 in taxes, what tax rate should be levied?

10. The cross section of a tunnel is $15' \times 16'$. The tunnel is $1\frac{1}{2}$ mi. long. How many barge loads, of 1600 cu. yd. each, will there be of the material excavated?

11. A yard stick perpendicular to the floor casts a shadow 28″ long; find the height of a flagstaff which at the same time casts a shadow 70′ long.

12. A 4-mo. note for $578.40 dated Jan. 15, was discounted Feb. 2 at 6%. What were the proceeds?

13. What will it cost at 75¢ a sq. yd. to pave a circular court having a radius of 40 feet?

14. Which has the larger area and by how much, a piece of copper in circular form with a diameter of $1\frac{1}{8}''$, or a piece in the form of a right triangle, having a base 20″ long and hypotenuse of 25″?

15. As agent you have a large consignment of grapes in your possession and you are instructed to sell as many pounds as will be necessary to produce net proceeds amounting to $370, after deducting 3% for commission and $12.20 for freight and cartage. At $2\frac{1}{4}¢$ per pound, how many pounds must you sell?

16. A speculator bought 250 shares of Bethlehem Steel at $297\frac{1}{4}$ and sold them at $299\frac{1}{8}$, brokerage $\frac{1}{8}$ in both transactions. Find the net proceeds.

17. At 30¢ per cubic yard, what will it cost to dig a cellar $48' \times 36'$ and $7\frac{1}{2}'$ deep?

18. A person sells 200 shares of Balt. and Ohio at $105\frac{1}{2}$ and invests the proceeds in mining stock at $70\frac{1}{8}$, paying $\frac{1}{8}\%$ brokerage in each case. How many shares of mining stock does he buy?

19. A 52-ft. ladder stands close to the side of a building. How many feet must it be pulled out at the bottom that the top may reach a window 48 ft. from the ground?

20. At 50¢ per sq. yd. what will it cost to plaster the walls and ceiling of a room 27′ long, 24′ wide, and 12′ high after deducting 288 sq. ft. for openings?

21. A room is 19′ wide and 23′ long. At $1.25 a yard what will it cost to carpet the room if the carpet runs lengthwise and is 27″ wide?

22. If a soldier marches 35 Km. a day, about how many mi. does he march?

23. Mr. Van Casteel paid gas bills for April, May, and June amounting to \$7.60. The May bill was $\frac{1}{2}$ of the April bill, but the June bill was $1\frac{1}{2}$ times the April bill. Find the amount of each month's bill.

24. How much tax will a farmer pay who is assessed for 275 acres of land at \$22 an acre, and for \$2500 personal property, the tax rate being $5\frac{1}{2}$ mills on a dollar, and the fee for collecting, 1%?

25. The Virginia Paper Co. collects a debt of \$75,000 through the bank, the proceeds being \$74,850. Find the rate for collection.

26. From a piece of cloth containing $38\frac{1}{2}$ yd. there were sold $2\frac{1}{2}$ yd., $4\frac{1}{8}$ yd., and $23\frac{1}{4}$ yd. What was the value of the remainder at \$1.20 per yard?

27. How many bricks each having a surface of $4'' \times 8''$ will be needed in paving a sidewalk 6′ wide and 180′ long?

28. Glass is 2.89 times as heavy as water. Find the weight of 12 cubic feet of glass.

29. How many board feet in 7 timbers, $6'' \times 6''$, each 16 feet long?

30. A certain district wishes to raise \$8125 by taxation. The assessed valuation is \$3,250,000. What will be the rate of taxation? What tax must a citizen pay whose property is assessed at \$50,000?

31. A train makes a run of $185\frac{1}{2}$ miles in 4 hours. If it maintains the same speed in its next run of $\frac{5}{7}$ hour, how many miles will it cover?

32. If the diameter of a wagon wheel is 4 ft., what is the circumference?

33. What is the cost of 149 Hl. of milk at 8¢ a liter?

34. Find the cost of linoleum for a kitchen $25' \times 18'$, the linoleum being 2 yd. wide at \$1.60 per yd.

35. From 1913 to 1917 the internal revenue receipts from the manufacture of tobacco were: \$70,590,151; \$76,789,424; \$79,986,639; \$79,957,373; \$88,063,947. What was the yearly average?

36. Find the face of a 60-day note which when discounted at 6% on the day it was made yielded as proceeds \$2089.

37. How much interest at 5% will \$12,500 earn from April 5 to Nov. 20?

38. If five men can finish a job in $8\frac{1}{2}$ da., in how many da. could 9 men complete it, working at the same rate?

39. A store insured for \$17,500 at \$1.25 per hundred is destroyed by fire at the end of 8 years, and the company pays $\frac{4}{5}$ of the claim. What part of the insurance received is the total premium paid?

40. Mrs. Petrie had \$850 in a savings bank Jan. 1, 1918. How much will she have at the end of two years, at 4% interest compounded semiannually, if she makes no deposits or withdrawals?

41. A 45-ft. tree casts a 24-ft. shadow when the sun is at a certain height. How far is it from the top of the tree to the end of the shadow?

42. Find the cost in U. S. money of three pieces of silk each 10 meters long and 75 centimeters wide at 5 fr. per square meter.

43. Calculate the capacity in cubic feet of a bin that will contain 1040 bushels.

44. What is the weight of the water that will half fill a rectangular tank $16' \times 6' \times 4\frac{1}{2}'$?

45. How much sheet iron will be needed to make a pipe 42 ft. high and $3\frac{1}{2}$ ft. in diameter?

46. What will be the bank discount and the proceeds of a note for \$700 for 90 da. at $3\frac{1}{2}\%$?

47. A laborer, killed in an accident, had earned an average weekly wage of \$17.20. What was the total amount paid to his one child left an orphan at the age of 8 years when the father died?

48. At $12\frac{1}{2}¢$ per sq. ft., find the cost of paving with cement a cellar 30 ft. long and 18 ft. wide.

49. A cylindrical well is 7′ in diameter and 42′ deep. How many bbl. of water does it contain when $\frac{2}{3}$ full?

50. Show graphically the changes in the production of beet sugar in the United States for six consecutive years.

	TONS		TONS
1911.....	8,500,000	1914.....	8,800,000
1912.....	6,800,000	1915.....	8,200,000
1913.....	8,900,000	1916.....	5,900,000

51. If 49,401 cords of wood were burned to heat 396 tents in one cantonment during Nov., how much wood was used in the average tent during that month?

52. If barbed wire costs $2\frac{1}{2}¢$ a ft., and 5 wires are to be strung around a field 42.5 rd. wide and 36.75 rd. long, compute the cost of the wire.

53. What is the length of the diagonal of a skating rink floor 82 ft. by 35 ft.?

54. A box in which soap is shipped measures $21'' \times 8\frac{1}{2}''$. If it contains 714 cu. in., how deep is it?

55. The diagonal of a rectangular field is 325 ft. long. If one side of the field is 204 ft. long, how long is the other side?

56. Compute the interest and the amount of \$2000 at 4% from Mar. 1, 1918, to Jan. 15, 1919.

57. Tell the weight of the water in a can holding 9 qt.

TABLES FOR REFERENCE

Avoirdupois Weight

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds (20 cwt.) = 1 ton (T.)
2240 pounds = 1 long ton (L. T.)

Troy Weight

24 grains (gr.) = 1 pennyweight (dwt.)
20 pennyweights = 1 ounce (oz.)
12 ounces = 1 pound (lb.)

---

1 oz. avoir. = 437½ gr. troy
1 lb. avoir. = 7000 gr. troy

Liquid Measure

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

31½ gal. = 1 barrel (bbl.)
2 bbl. = 1 hogshead (hhd.)

1½ gal. = 231 cu. in.
7½ gal. = about 1 cu ft.

Dry Measure

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

---

1 bu. = 2150.42 cu. in., or about 1¼ cu. ft.

Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
365 days = 1 common year (yr.)
366 days = 1 leap year
12 months (mo.) = 1 year
10 years = 1 decade
10 decades or 100 years = 1 century (cen. or C.)

Thirty days has September,
April, June, and November;
All the rest have thirty-one,
Excepting February alone,
To which we twenty-eight assign,
Till leap year gives it twenty-nine.

Counting

2 units = 1 pair (pr.)
12 units = 1 dozen (doz.)
12 dozen = 1 gross (gr.)
12 gross = 1 great gross (gr.gr.)
20 units = 1 score

Paper Measure

24 sheets (sht.) = 1 quire (qr.)
20 quires or 480 sheets = 1 ream (rm.)

---

500 sheets are usually called a ream.

Linear Measure

12 inches (in.) ($''$) = 1 foot (ft.) ($'$)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods or 1760 yards or 5280 feet = 1 mile (mi.)

---

4 in. = 1 **hand**; 6 ft. = 1 **fathom**; 40 rd. = 1 **furlong**;
6080.27 ft. = 1 **knot**, or nautical mile = about 1.15 land mi.

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards or $272\frac{1}{4}$ square feet = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mi. (sq. mi.)

---

36 square miles = 1 township
640 acres = 1 section
160 acres = 1 quarter-section

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
128 cubic feet of wood = 1 cord (cd.)

Wood, when cut, is usually stacked in piles 8 ft. × 4 ft. × 4 ft.
These piles, containing 128 cu. ft., are called cords; $\frac{1}{8}$ of a cord, or a layer of wood 4 ft. × 4 ft. × 1 ft., is called a cord foot.

Useful Equivalents

1 barrel (bbl.) = $31\frac{1}{2}$ gal. = $4\frac{1}{5}$ cu. ft.
1 hogshead (hhd.) = 63 gal.
1 gallon (gal.) = 231 cu. in.
1 bushel (bu.) = 2150.42 cu. in. = $1\frac{1}{4}$ cu. ft.
1 ton of coal = 35 cu. ft.
1 cu. ft. of water = $62\frac{1}{2}$ lb.

1 bu. of wheat = 60 lb.	1 bbl. of beef = 200 lb.
1 bu. of corn = 56 lb.	1 bbl. of pork = 200 lb.
1 bu. of rye = 56 lb.	1 bu. of oats = 32 lb.
1 bbl. of flour = 196 lb.	1 bu. of potatoes = 60 lb.

Circular Measure

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circumference

---

90 degrees, or $\frac{1}{4}$ of a circumference, is called a **quadrant.**
An angle of 90 degrees is called a right angle.

United States Money

10 mills = 1 cent (ct., c., or ¢)
10 cents = 1 dime (di.)
10 dimes = 1 dollar ($)
10 dollars = 1 eagle (*in gold only*)

---

1 cent (copper) is called a penny;
5 cents (nickel) is called a nickel;
25 cents (silver) is called a quarter;
50 cents (silver) is called a half-dollar;
20 dollars (gold) is called a double-eagle.

Foreign Moneys

COUNTRY	STANDARD	EXACT VALUE	APPROX. VALUE
Argentina	Peso	$.965	$1.00
Austria	Crown = 100 heller	.203	.25
Belgium	Franc	.193	.20
Bolivia	Boliviano	.389	.40
Brazil	Milreis	.546	.50
Canada	Dollar	1.00	1.00
Central Am.	Peso	.435	.50
Chile	Peso	.365	.40
China	Tael { Canton	.711	.70
	Tael { Haikwan	.726	.70
	Tael { Shanghai	.651	.70
Colombia	Dollar	1.00	1.00
Denmark	Crown	.268	.25
Ecuador	Sucre	.487	.50
Egypt	Pound = 100 piasters	4.943	5.00
France	Franc = 100 centimes	.193	.20
Germany	Mark = 100 pfennig	.238	.25
Great Britain	Pound = 20 shillings	4.8665	5.00
	Shilling = 12 pence	.2433	.25
	Penny = 4 farthings	.0203	.02
Greece	Drachma	.193	.20
Hayti	Gourde	.965	1.00
Holland	Florin or Gulden	.402	.40
India	Rupee	.324	.30
Italy	Lira = 100 centesimi	.193	.20
Japan	Yen = 100 sen	.498	.50
Mexico	Peso	.498	.50
Norway	Crown	.268	.25
Panama	Balboa	1.00	1.00
Peru	Libra	4.8665	5.00
Portugal	Milreis	1.08	1.00
Russia	Ruble = 100 kopecks	.515	.50
Spain	Peseta	.193	.20
Sweden	Crown	.268	.25
Switzerland	Franc	.193	.20
Turkey	Piaster	.044	.05
Uruguay	Peso	1.034	1.00
Venezuela	Bolivar	.193	.20

METRIC SYSTEM

Linear Measure

10 millimeters (mm.) = 1 **centimeter** (cm.)
10 centimeters = 1 **decimeter** (dm.)
10 decimeters = 1 **meter** (m.)
10 meters = 1 dekameter (Dm.)
10 dekameters = 1 hektometer (Hm.)
10 hektometers = 1 **kilometer** (Km.)
10 kilometers = 1 myriameter (Mm.)

---

1 centimeter = about $\frac{2}{5}$ inch
1 decimeter = almost 4 inches
1 meter = 39.37 inches
1 kilometer = about $\frac{5}{8}$ mile

Square Measure

100 sq. millimeters (sq. mm.) = 1 sq. centimeter (sq. cm.)
100 sq. centimeters = 1 sq. decimeter (sq. dm.)
100 sq. decimeters = 1 sq. meter (sq. m.)
100 sq. meters = 1 **sq. dekameter** (sq. Dm.)
100 sq. dekameters = 1 sq. kilometer (sq. Km.)

The sq. dekameter is the standard for the measurement of land and is called the **are.**

Land Measure

100 centares (ca.) = 1 are (a.)
100 ares = 1 **hektare** (Ha.)

The hektare is 2.471 acres (approx. $2\frac{1}{2}$ acres).

Cubic Measure

1000 cu. millimeters (cu. mm.) = 1 **cu. centimeter** (cu. cm.)
1000 cu. centimeters = 1 **cu. decimeter** (cu. dm.)
1000 cu. decimeters = 1 **cu. meter** (cu. m.)

The cu. cm. is used to get the **standard of weight.**
The cu. dm. is used to get the **standard of capacity.**
The cu. m. is used to get the **standard of wood measure.**

Measures of Weight

10 milligrams (mg.)	= 1 centigram (cg.)
10 centigrams	= 1 decigram (dg.)
10 decigrams	= 1 **gram** (g.)
10 grams	= 1 dekagram (Dg.)
10 dekagrams	= 1 hektogram (Hg.)
10 hektograms	= 1 **kilogram** (Kg.)
10 kilograms	= 1 myriagram (Mg.)
10 myriagrams	= 1 quintal (Q.)
10 quintals	= 1 **metric ton** (M. T.)

The gram is the weight of 1 cu. cm. of distilled water, and is about $\frac{1}{28}$ oz. avoirdupois.

The kilogram, or kilo, equals 2.2046 lb., and is used in weighing ordinary groceries, etc.

The metric ton equals 1.1023 English tons, approx. 2204 lb., and is used for weighing coal, iron, etc.

Dry and Liquid Measures

10 milliliters (ml.)	= 1 centiliter (cl.)
10 centiliters	= 1 deciliter (dl.)
10 deciliters	= 1 **liter** (l.)
10 liters	= 1 dekaliter (Dl.)
10 dekaliters	= 1 **hektoliter** (Hl.)
10 hektoliters	= 1 kiloliter (Kl.)

The liter is used to measure milk, etc., and equals approximately the quart: .908 qt. dry; 1.0567 qt. liquid.

The hektoliter is used to measure potatoes, etc., and is the equivalent of 2.8377 bushels.

The kiloliter is used to measure hay, etc., and is not used commonly.

Wood Measure

10 decisteres (ds.)	= 1 stere (s.)
10 steres	= 1 dekastere (Ds.)

The stere approximates $2\frac{1}{6}$ cord feet of cut wood.

The dekastere is a little more than $2\frac{3}{4}$ cords.

INDEX

	PAGE
Above par	111, 132
Acceptance	110
Account, bank	98
household	67, 165
savings bank	26
weekly expense	68
Addition	1, 82
Ad valorem	124
Antecedent	50
Applications, industrial	151
of percentage	18, 90
Arc	36
Are	48
Area of a circle	38
of a trapezoid	35
Assessment	133
Assessors	127
Bank account	98
discount	102–105
drafts	107
Banks, commercial	97
of deposit	97
savings	26, 97
Below par	111
Board foot	156
measurement	156
Board of directors	133
Bonds	138, 139
government	140
rate of income on	140
Borrowing money	102
Broker	135
Brokerage	135
Business forms	67, 165
Business of corporations	131
Capacity, metric table of	47, 181
of tanks and bins	158
Capital	131
Carpeting	155
Centimeter	45
Certificate, stock	130, 131
Charter	131
Checks	100
payment by	105
Circle	36
area of	39
Circumference	36
City and state expenses	126
taxes	127
Commercial banks	97
draft	109
Common fractions, review of	8, 87
Common stock	133
Company, stock	131
Compensation, workmen's law	121
Compound interest	26–30
Consequent	50
Convex surface	43
Corporations, business of	131
Coupons, interest	139
Cube root	146
Cubic measure, metric table of	49, 180
Cylinder, surface of	43
volume of	42

	PAGE
Decimal fractions, review of	9, 87
Deposit, banks of	97
slip	98
Diameter	36
Directors, board of	133
Discount, bank	102–105
Dividends	132
Divisibility, tests of	5
Division	5, 86
short methods in	6, 85
Drafts, bank	107
commercial	109
time	110
Drawer	100
Drawing interest	27
Drawing to scale	151
Duties	124
Endowment policy	119
Equations	76, 167
Excavating and paving	157
Exchange	105–112
market	111
stock	135
Expense account, weekly	68
Expenses and revenues, government	123
state and city	126
Express money order	106
Extremes	52
Face of policy	116
Forms, business	67, 165
Fractions, review of common	8, 187
review of decimal	9, 187
Government bonds	140
expenses and revenues	123
Gram	45, 47
Graphs	159–161
Hektare	48
Hektoliter	47
Horizontal addition	2
Household accounts	67, 165
Hypotenuse	150
Income, rate of on bonds	140
Indorsement	100
Industrial applications	151
problems	60
Insurance	116
Interest, compound	26–30
coupons	139
simple	22–25
tables	23, 24, 29
Internal revenue	125
Investing money	141
Kilogram	47
Kilometer	45
Length, metric table of	45, 180
Life insurance	118
Limited payment life policy	119
Liter	45, 47
Market, exchange	111
Means	52
Measurement	34, 145
board	156
Meter	45
Metric system,	45–49, 180
table of capacity	47, 181
table of cubic measure	49, 180
table of length	45, 180
table of square measure	48, 180
table of weight	47, 181
ton	47

PAGE

Millimeter 45
Money and interest 22
banks and banking . . . 97
borrowing 102
investing 141
Money order, express 106
postal 106
telegraphic 106

Multiplication 4, 83
short methods in . . . 6, 85
Municipal taxation: New York 128

New York, municipal taxation 128
Note, promissory 102

Oral drill exercises 14, 31, 57, 73, 79, 94, 113, 142, 162, 169
Ordinary life policy 119

Painting 153
Papering 154
Par 111, 132
Parallelogram 34
Pass book 98
Paving and excavating . . . 157
Payee 100
Payments by check 105
by express money order . 106
by draft 107–110
by postal money order . . 106
by telegraphic money order 106
Percentage, applications of . 18, 90
Period, interest 27
Periods 147
Personal property 127
Pi 37
Plastering 152
Policy 116
endowment 119

PAGE

Policy, face of 116
limited payment life . . 119
ordinary life 119
Postal money order 106
savings system 101
Powers, raising to 145
Practice with numbers . . . 82
Preferred stock 133
Prefixes, use of 46
Premium 111, 116
Prism, volume of 41
Problems, general written, 15, 32, 58, 74, 80, 95, 114, 143, 163, 170
industrial 60
Proceeds 102
Promissory note 102
Property, personal 127
Proportion 52

Quotations, stock 135

Radius 36
Rate of income on bonds . . 140
Rate, tax 127
Ratio 50
Real estate 127
Rectangles, review of 34
Rectangular solids 39, 40
Relation of diameter to circumference 36
Revenue, internal 125
Revenues, government expenses and 123
Reviews 1, 8, 9, 11, 22, 34, 82, 87, 90
Root, cube 146
square 146–149

Savings banks 26, 97
Sector 36
Sight draft 109

	PAGE
Sign of ratio	50
Similar triangles	54
Simple equations	76, 167
interest	22–25
Short methods of multiplying and dividing	6, 7, 85
Solids	39–44
Specific duty	124
Square measure, metric table of	48, 180
root	146–149
State and city expenses	126
taxes	127
Stock certificate	130
common	133
company	131
exchange	135
preferred	133
quotations	135
Stub	100
Subtraction	3, 83
Surface, convex	43
Surfaces of cylinders	43, 44
of rectangular solids	39
Table, compound interest	29
of days between dates	23
simple interest	24
Tables for reference	175
Tax rate	127
Taxation, municipal: New York	128
Taxes	123
Telegraphic money order	106
Term, interest	27
of discount	102
Terms of ratio	50
Tests of divisibility	5
Time draft	110
Transmitting payments, ways of	105
Trapezoid	35
Triangle, hypotenuse of	150
Triangles, review of	34
similar	54
Trust company	97
Weekly expense account	68
Weight, metric table of	47, 181
Workmen's compensation law	121
Volume	39
of a cylinder	42
of a prism	41
of a rectangular solid	39
Vouchers	98